VOLUME 16/NUMBER 23
DECEMBER 8, 1978
ACC. NOS. N78-32036 TO N78-33034

STAR

AN ABSTRACT JOURNAL

Scientific and Technical Aerospace Reports

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Scientific and Technical Aerospace Reports, Volume 16, is prepared by the NASA Scientific and Technical Information Facility operated for the National Aeronautics and Space Administration by Informatics Information Systems Company.

The Administrator of the National Aeronautics and Space Administration has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Agency. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through June 30, 1981.

US ISSN 0036-8741

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AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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For related information see also *34 Fluid Mechanics and Heat Transfer*.

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For related information see also *34 Fluid Mechanics and Heat Transfer*.

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Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

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Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

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For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

CHEMISTRY AND MATERIALS

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83 ECONOMICS AND COST ANALYSIS 3151
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 3151
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 3151
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 3153
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 3154
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 3156
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 3156
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 3162
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

GENERAL

99 GENERAL 3163

Note: N.A. means that no abstracts were assigned to this category for this issue.

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CORPORATE SOURCE INDEX I-53
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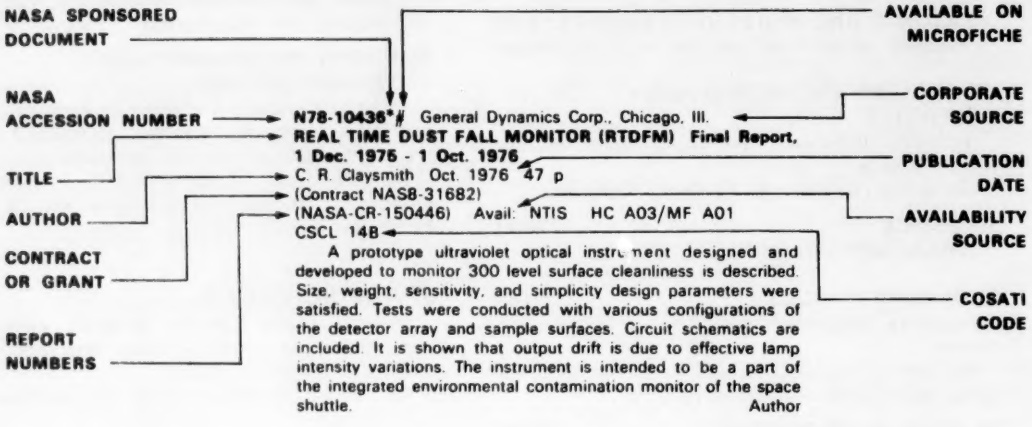
TYPICAL CITATION AND ABSTRACT


NASA SPONSORED DOCUMENT
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NASA ACCESSION NUMBER
N78-10436*# General Dynamics Corp., Chicago, Ill.
CORPORATE SOURCE
REAL TIME DUST FALL MONITOR (RTDFM) Final Report, 1 Dec. 1975 - 1 Oct. 1976
TITLE
C. R. Claysmith Oct. 1976 47 p
PUBLICATION DATE
AUTHOR
(Contract NAS8-31682)
CONTRACT OR GRANT
(NASA-CR-150446) Avail: NTIS HC A03/MF A01
AVAILABILITY SOURCE
CSCL 14B
REPORT NUMBERS
A prototype ultraviolet optical instrument designed and developed to monitor 300 level surface cleanliness is described. Size, weight, sensitivity, and simplicity design parameters were satisfied. Tests were conducted with various configurations of the detector array and sample surfaces. Circuit schematics are included. It is shown that output drift is due to effective lamp intensity variations. The instrument is intended to be a part of the integrated environmental contamination monitor of the space shuttle.
Author
COSATI CODE

ON-GOING RESEARCH PROJECTS

This is a listing of research projects — not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, AUTOMATIC LAUNCHING/LOADING TECHNIQUES - HELICOPTER SYSTEMS
G.T. LAMAR, U.S. Army, Technology Laboratory, *Redstone Arsenal, Huntsville, Alabama* 35809 (DA0F1401)

Investigate the depot-to-fire sequence of future systems and develop transport-load-launch-reload concepts minimizing manpower requirements and total sequence time for helicopter launch systems.

A full study of the techniques for rapid load and reload of helicopters will be conducted. Automatic boresighting features, self-loading hardback design, rough terrain loaders and techniques to satisfy the complete wooden round philosophy will be investigated. A tri-service/NATO survey will be conducted. Prototype hardware of promising concepts will be designed, developed, and tested.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Ground Equipment & Missile Structures Directorate

1.0002, SWEPT FORWARD WING CONCEPT ANALYSIS
M.R. ROBINSON, Rockwell International Corp., *International Airport, Los Angeles, California* 90009 (DF140980; AFFDL-2402-03-04)

High performance aircraft engaged in transonic combat maneuvers are currently limited in turn rate capability and require continuing high level attention. A radical new concept may be required to meet the deficiency. One such concept requires that the wings be swept forward in order to achieve the needed drag reduction and reduced static margin. Until recently the forward swept wing was ruled out owing to its inherent loss of static stability due to excessive wing bending. The combination of aeroelastic tailoring and active controls, both newly emerging technologies, may overcome the stability loss permitting full realization of the benefits of forward sweep. A complete investigation combining aerodynamics, structures and control technology is to be conducted.

Conduct detailed analysis of aerodynamic features of swept forward wings. Examine structures, requirements and capabilities. Investigate application of active controls. Perform design studies and identify appropriate ground test requirements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0003, DESIGN STUDY OF THERMOPLASTIC WING
UNKNOWN, General Dynamics Corporation, Convair Division *P.O. Box 1950, San Diego, California* 92112 (DN890062 N00019-78-C-0083)

Identify fiber-reinforced thermoplastic wing design approaches compatible with manufacturing/quality assurance capabilities for these materials and their associated weight/cost attributes.

Conduct design and analysis trade studies to identify weight, cost and other functional characteristics of alternative wing designs. Build and test critical sub-elements to support the analyses.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0004, RPV (REMOTELY PILOTED VEHICLE) ADVANCED LAUNCHER SYSTEM
B. KURZ, Teledyne Incorporated, Teledyne Ryan Aeronautical Div, *7155 Mission Gorge Rd., San Diego, California* 92120 (DA0E3779; DAAJ02-77-C-0048)

To perform an evaluation and selection of RPV launcher systems compatible with U.S. Army operations and environmental factors.

To seek, search out, and document available launch techniques and provide rating factors pertinent to Army missions.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0005, AIR DATA STUDY (VTOL AND V/STOL)
R.C. VESQUE, Signal Companies Incorporated, Airesearch Mfg Co, *2525 W. 190th St., Torrance, California* 90509 (DN881387; N62269-77-C-0253)

To develop an air data system to meet the special requirements of VTOL and V/STOL (vertical and short take-off and landing) aircraft. This contract supports work unit ZA601, Agency Accession No. DN681080.

Survey and document current mission requirements and deficiencies in air data information. Review related crash and safety reports. Determine requirements not being met by use of conventional aircraft technology and determine technologies available to meet the unique requirements of VTOL and V/STOL aircraft in the future. Prepare development specification requirements.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0006, SPANWISE DRAG DISTRIBUTION FOR SWEPT WINGS
R.L. FEARN, State University of Fla. Sys., School of Engineering, Aerospace Engineering, *220 Black Hall, Gainesville, Florida* 32611 (NSG 1542)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

1.0007, IMPACT OF INTERNATIONAL NOISE ABATEMENT REGULATIONS ON THE U.S. AIRCRAFT MANUFACTURING AND AIR CARRIER INDUSTRIES
F.A. SPENCER, Northwestern University, Graduate School, *633 Clark St., Evanston, Illinois* 60201 (NSG 2328)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

1.0008, TORSION-BENDING FLUTTER OF VISCOELASTIC WINGS

H.H. HILTON, Univ. of Illinois, School of Engineering, Aeronautical & Astronaut Engin, *2527 Hydrosystems Lab., Urbana, Illinois* 61801

An analysis of subsonic and supersonic torsion-bending flutter, including rotary inertia, shear and heating effects, of a time dependent linear viscoelastic lifting surface consisting of either a Bernoulli-Euler or a Timoshenko beam is formulated using aerodynamic strip theory. Complex moduli models for aluminum are characterized as functions of temperature and frequency by fitting Chebyshev polynomials to actual material experimental data.

The flutter analysis is carried out in the complex plane and a computerized iterative method for the determination of flutter speeds and frequencies is developed. The influence of viscoelastic material properties (storage and loss moduli) temperature, rotary inertia and shear effects is evaluated. The results of the analysis show that in the presence of viscoelastic material damping it is possible to obtain flutter velocities and frequencies which are smaller than undamped elastic ones for the same geometric lifting surface.

The effects of structural damping in combination with viscoelastic damping are also under investigation.

SUPPORTED BY University of Illinois

1.0009, DEVELOPMENT OF A STOCHASTIC THEORY OF ROTOR BLADE DYNAMICS 15193-E

Y.K. LIN, Univ. of Illinois, School of Engineering, Aeronautical & Astronaut Engin, *2527 Hydrosystems Lab., Urbana, Illinois* 61801 (DA0F9151; DAAG29-78-G-0039)

To develop a comprehensive stochastic theory of rotor blade dynamics capable of predicting instability in the presence of atmospheric turbulence. Relevance: Results from this research could be significant for the understanding and eventual design improvements of the Army helicopter rotors.

The standard equations of motion are generalized to include the effects of turbulence. Stability is defined in terms of stochastic convergence and the stochastic differential equations are solved using the method of Stratonovich. A limited experimental program will be carried out to provide data for comparison with the theoretical results.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

1.0010, ANALYZE AND TEST THE FLIGHT CONTROL SYSTEM FOR THE DAST VEHICLE

A. KOTSABASIS, Univ. of Kansas, Graduate School, *214 Strong Hall, Lawrence, Kansas* 66044 (NSG 4017)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

1.0011, INVESTIGATION OF OPTIMUM WING CONFIGURATIONS WITH EDGE SEPARATION

C.E. LAN, Univ. of Kansas, School of Engineering, Aerospace Engineering, *Learned Hall, Lawrence, Kansas* 66044 (NSG 1537)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

1.0012, FLUIDIC EVENT SEQUENCING SUBSYSTEM (FESS) OF BALLISTIC SYSTEMS

M.A. HENDERSON, U.S. Navy, Ordnance Station, *Indian Head, Maryland* 20640 (DN696206)

To evaluate/demonstrate the feasibility of (1) utilizing fluidics to obtain longer installed life and improved accuracy and reliability in the sequencing of ballistic systems, and (2) a flueric cartridge initiator (FCI) to obtain a safer and more reliable means of initiating ballistic charges.

This work unit encompasses the development of a flueric cartridge initiator (FCI), a fluidic sequencer (FS), an FCI/FS interface device, and a warm gas generator. Flueric cartridge initiator (FCI): the FY 77 FCI effort will concentrate on the design, fabrication, and testing of a steel resonance tube configuration to minimize components and increase reliability. An integral cup/resonance tube with an ultrasonically welded thermal disk will be pursued. This will minimize the number of parts required for assembly and will reduce function time variations resulting from the existing assembly design. Design feasibility and reliability testing will be performed during FY 77 and FY 78. Fluidic sequencer (FS): the FY 77 FS effort will center around obtaining improved accuracy through incorporation of the vibrating beam oscillator into the breadboard. An FCI/FS interface device design will be pursued. Design of escape systems components compatible with AAES geometries will begin. In FY 78, the CAD components will be fabricated and design feasibility tests performed on the all-up fluidic event sequencing subsystem (FESS) assembly. During FY 77, methods of obtaining gas generator rise times and long burn times required for FS operation will be investigated. Prototype gas generators will be fabricated and tested across the temperature range of minus 65 F to plus 2 F. In FY 78, the gas generator will be further optimized in terms of envelope and output, and tested at environmental extremes for performance determination. Funds permitting, fluidic sequencer components will be tested with the gas generator output to determine hydrogen gas particulate matter/gas temperature effects.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0013, ENERGY CONVERSION - COMPRESSOR BLADE FLUTTER MEASUREMENT USING RETROREFLECTORS

J.L. KERREBROCK, Mass. Inst. of Technology, School of Engineering, Aeronautics & Astronautics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DN775111; N00014-77-C-0106)

The objective of this project is to assess the viability of compressor blade flutter measurements utilizing a retroreflector technique under development at Aerodyne Research, Inc. The effort is experimental in nature and is aimed at direct measurements of aerodynamic damping coefficients in terms of interblade phase angle, tip mach number, and pressure ratio. This research will contribute to an increased understanding of the effects on performance of one of the limiting factors in the design of fan and compressor blades (blade flutter), and hopefully result in increased performance of gas turbine engines needed for naval aircraft propulsion, but useful as well to marine power plants and fixed installations.

An instrument designed, built, and calibrated by Aerodyne Research, Inc. Will be procured by the M.I.T. Gas Turbine Laboratory. It will be utilized in an M.I.T. blowdown compressor to conduct blade flutter measurements for correlation with conventional on-going flutter research.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

1.0014, SUPERCRITICAL WING FLUTTER

J.A. MCGREW, McDonnell Douglas Astro. Co., *E. 411 St., St. Louis, Missouri* 63166 (DF140620; F33615-77-C-3101)

Supercritical wings provide increased aerodynamic efficiency by delaying the drag rise, thus allowing the aircraft to cruise efficiently at a higher mach number. Recent NASA test data has shown that the flutter characteristics of supercritical wings can be significantly different from wings with conventional airfoils. The objective of this effort is to evaluate and improve flutter prediction methods for supercritical wings. These improved flutter prediction methods will assure flight safety for aircraft with supercritical wings.

Using the available NASA test data, correction factors will be developed for the doublet-lattice theory. New transonic prediction methods will also be applied and correlated with the test data. The improved flutter prediction method will be applied to a new aircraft with a supercritical wing design.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0015, DIGITAL DATCOM IMPROVEMENT

J.E. WILLIAMS, McDonnell Douglas Astro. Co., *E. 411 St., St. Louis, Missouri* 63166 (DF140200; F33615-77-C-3073)

This work unit supports TPO 3, flight control and major thrust FG02B, flight control system design techniques. Rapid and inexpensive methods for predicting the aerodynamic stability and control characteristics of Air Force weapon systems are needed. The objective of this work unit is to extend the capability which now exists in the USAF stability and control digital DATCOM by: (1) updating the program to agree with the 1976 revision to the USAF stability and control DATCOM, (2) improving the implementation of the transonic methods, and (3) reducing engineering analysis time by modifying the input and output characteristics. The availability of these methods will lead to better aircraft designs by permitting rational trade-offs to be considered early in the design.

Computational method modules will be updated to reflect the latest revisions to DATCOM, to provide non-linear fairing of transonic output, and to incorporate a standard atmosphere model. Input requirements will be made more flexible by permitting altitude and flight speed to be specified in lieu of Mach number and Reynolds number, and expanding the addressable configurations by allowing ventral fins. Output interpretation will be simplified by introducing a plot option and by greatly condensing the extrapolation warning message output.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0016, V/STOL - SHIP INTERFACE SYSTEMS

T. GIOA, U.S. Navy, Engineering Department, *Lakehurst Naval Air Station, Lakehurst, New Jersey* 08733 (DN696001)

The advent of V/STOL aircraft generated the need to study the problems related to V/STOL operations from aviation and non-aviation ships. Studies will include V/STOL launch assist, emergency recovery of V/STOL aircraft, environmental protection of personnel, ship, aircraft, and auxiliary equipment during vertical take-off and landing, visual landing aid requirements, and interface of these areas with the aviation on non-aviation ship.

Specific element areas will be studied together with ship interface requirements as follows: (1) V/STOL recovery - studies will be conducted to determine methods of recovery of V/STOL aircraft during emergencies when the aircraft cannot land in the normal vertical mode. Studies will include operations during high wind and rough sea conditions; (2) V/STOL related environmental hazards - methods of protecting personnel, ship, aircraft, and equipment will be investigated; (3) visual landing aids -studies to establish design parameters for visual landing aid systems for vertical take-off and landing of V/STOL aircraft on ships will be made; (4) V/STOL launch assist - studies will be conducted of various launcher concepts to provide substantial aircraft weight reduction with concomitant increase in mission capability.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0017, ADVANCED TECHNOLOGY PAYOFFS STUDY FOR NAVY V/STOL AIRCRAFT

N. DANINHOFFER, Grumman Corporation, *S. Oyster Bay Rd., Bethpage, New York* 11714 (DN881376; N62269-78-C-0034)

To establish a rationale for commitment of systems development resources to advanced structural concepts vs. other subsystems. Program involves a comparative study of the relative system payoff to be gained from the development of advanced structure technology (especially composites) compared to improvements in other major subsystems. This work is in support of work unit ZA601, 'Aircraft Technology', Agency Accession No. DN 681080.

This program will provide the return on investment for several applicable technology areas which promise high potential payoffs for high-performance Navy V/STOL aircraft. The study will develop a payoff analysis methodology that will enable an objective evaluation of V/STOL advanced technology investment decisions. This methodology will then be used to trade off investments in major payoff technologies in the categories of structures, propulsion and aerodynamics. This shall be accomplished by trading off new investment costs for alternate technology developments against life-cycle costs and IOC dates for V/STOL configurations using advances in the subject technologies. The output of the study will be a recommended investment plan for the technologies evaluated and recommendations for further application of the methodology for an all-inclusive investment analysis.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0018, CREW STATION DESIGN FACILITY FEASIBILITY STUDY

S. LACARRUBBA, Grumman Corporation, Grumman Aerospace, *S. Oyster Bay Rd., Bethpage, New York* 11714 (DF141530; F33615-77-C-3067)

This effort will support the development of new display concepts for advanced aerospace crew stations. A USAF pilot opinion survey identifies numerous serious cockpit lighting and display legibility problems which impact day/night mission performance. The increasing numbers of multipurpose light emitting displays (cathode ray tube displays) used in conjunction with complicated future weapon systems further substantiates the need for definitive display design criteria. the objective of this effort is to determine the feasibility of building a test facility capable of simulating the broad range of extreme illumination conditions experienced in air-to-air combat, air-to-ground weapons delivery, and other critical day/night mission phases. Dynamic lighting simulation capability will permit evaluating cockpit lighting and display legibility from a systems viewpoint within the context of more realistic mission conditions. This capability will also permit formulation of meaningful cockpit lighting and display legibility design criteria.

This effort is the initial phase in the development of a crew station design facility. A feasibility and design study to define trade offs, technical limitations and overall design of the test facility will be contracted. The study will provide information concerning description, location, type of simulated features (such as air targets, ground targets, flares, and extreme ambient illumination sources) and the simulator enclosure itself. The results of the study will be used in a future detailed design study preliminary to construction of the facility.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0019, ADVANCED ELECTRONIC FLIGHT CONTROL SYSTEM DEVELOPMENT (INTEGRATED SENSORY SUBSYSTEM)

W.D WEISTEIN, Grumman Corporation, Aerospace Corporation, *S. Oyster Bay Rd., Bethpage, New York* 11714 (DN881143; N62269-77-R-0341)

To develop a fail-operational, combat-survivable, and highly reliable angular rate sensor system for future Navy aircraft. This contract supports work unit ZA601, Agency Accession No. DN681080.

Design and fabricate the mechanical and electrical equipment necessary to install, instrument, check out, and flight-test the ASSET III (Advanced Skewed Sensory Electronic Triad) system in an A-6A aircraft.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0020, FLIGHT EVALUATION OF THROTTLE EM FOR TRANSPORT

B. LITMAN, A M B A C Industries Inc., *900 Old Country Rd., Garden City, New York* 11530 (DF139730; F33615-77-C-3028)

The Air Force stands to gain substantial fuel-cost benefits through the use of fuel saving energy management flight profiles. The high costs of hydrocarbon fuels as compared with pre-1973 levels continue to impact military aircraft operations. Real time energy management techniques for fuel conservation have recently been analyzed for large military transport aircraft (C-141) and compared with typical flight handbook trajectoreis by means of digital simulation. Considerable fuel and cost savings were realized by following the optimal altitude/velocity profiles. Verification of these savings in flight through implementation and

testing of fuel conserving control algorithms and system concepts is now required.

It is hoped that initial confirmation of fuel savings potential can be obtained using portable computation equipment on-board operational C-141 aircraft flying routine missions. Subsequent effort would then be directed toward incorporation of the fuel conserving control laws in an on-board computer system with appropriate pilot interface (to minimize workload) and flight validation of performance.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0021, INFLUENCE OF AUDITORY INPUTS ON SIMULATED FLIGHT OPERATIONS

E. GALANTER, Columbia University, School of Arts & Sciences, Psychology, *Broadway & W. 116th St., New York, New York* 10027 (NSG 1541)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

1.0022, CLOSED ENVIRONMENTAL CONTROL SYSTEM EVALUATION

R.W. WATTS, U.S. Air Force, Flight Dynamics Lab., *Wright Patt. A.F.B., Dayton, Ohio* 45433 (DF141540)

Future high performance military aircraft will encounter severe mission penalties if conventional approaches to the environmental control system (ECS) are used. Reduction of significant mission take-off-gross-weight (TOGW) penalties is possible through development of a closed-loop ECS. This ECS concept can reduce engine bleed air and ram air penalties by approximately 80 percent. Additional reliability and cost savings are attainable through new designs. The objective of this effort is to develop criteria for the most important elements of the closed-loop ECS (the air cycle machine (ACM), drive system, expansion devices).

Test those elements of a closed loop ECS that are needed to improve the life cycle cost of advanced aircraft. These elements would include the ROVAC models 607 and 608 ACM, a closed loop hydraulic drive, and various expansion and refrigeration machines which will enhance closed ECS performance. Initiate analysis programs to determine the stability and control characteristics of various closed-loop ECS configurations. for example, a model shall be constructed on the 'easy' dynamics program to study closed-loop arrangements under dynamic inputs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0023, DESIGN OF SELECTED CONCEPTS - CH-47 TERRAIN FLYING WITH EXTERNAL LOADS

J. DAVIS, Boeing Company, *P.O. Box 16858, Philadelphia, Pennsylvania* 19142 (DA0E3793; DAAJ02-77-C-0069)

To improve the capability of helicopters to conform to terrain flying requirement while engaged in delivering supplies/equipment in forward areas under high level air defense threat environments.

A preliminary design of the load snubbing system concept will be formulated and subjected to analysis to define system size, performance, aircraft interactions, schedules and cost data.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0024, DEMONSTRATION OF ADVANCED CARGO RESTRAINT HARDWARE FOR COD AIRCRAFT

J. SHEFRIN, Boeing Company, *P.O. Box 16858, Philadelphia, Pennsylvania* 19142 (DN881347; N62269-77-C-0429)

This effort is intended to demonstrate advanced cargo restraint hardware components and the integrated restraint of a unit of cargo. The demonstration hardware and dynamic testing is part of a program of hardware/system concept assessment for Navy COD and V/STOL VOD type aircraft. The objectives of an advanced cargo restraint system for COD aircraft include reduced turnaround time (for cargo handling, tiedown, release, reconfiguration) and minimum cost. Energy management design technology will be applied to enhance system integrity and crew/passenger survivability under aircraft crash conditions.

Demonstration restraint hardware will be provided for installation and testing at the NavAirDevCen horizontal accelerator facility. The effort will include analysis, design, and fabrication of adjustable restraint tension members and load limiters, and supply of tiedown hardware for the restraint of a unit of cargo. An installation and test plan will be provided. Hardware installation and testing will be accomplished by the NavAirDevCen.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0025, SIMULATION DISPLAYS - WIDE FIELD OF VIEW

R.L. JONES, U.S. Navy, Air Development Center, *Warminster, Pennsylvania* 18974 (DN781476)

TECHNICAL OBJECTIVE: The general objective of this task is to examine the state-of-the-art concepts for generating wide field-of-view displays and to consider their application to 'out-the-window' scene generation for flight simulators. Recent advancements in computer generated imagery, video projections systems, electrooptics, and large diameter cathode-ray tubes have given impetus to the development of a broad spectrum of display systems. The application of these display systems to flight simulators and the presentation of visual cues to flight crew is the specific objective of this task. The knowledge and expertise gained through this study would be applied to the development of visual systems for near term NavAirDevCen flight simulators.

APPROACH: Survey the state-of-the-art in the technologies of electrooptics, computer generated imagery, optical projection systems and multi-cathode ray tube display systems. Investigate any current application of this technology in simulator visual display systems and, in addition, explore new approaches. A paper study and preliminary design will follow which will address the future display requirements for NavAirDevCen simulators. The findings and preliminary design will then be documented and released to the DOD simulation community.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0026, FEASIBILITY DEMONSTRATION OF A RETARDATION AND AUTOMATIC FLOTATION (RAFT) SYSTEM FOR THE 'VERTREP' MISSION

W. WIESMANN, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974 (DN681034)

Demonstrate the feasibility of a helicopter installed system designed to provide deceleration during free fall, and subsequent flotation, of a high value cargo that has been intentionally jettisoned or inadvertently dropped during vertical replenishment operations over water. Automatic deployment of the system is planned to prevent specified levels of damage to the cargo upon impact with the water, to avert sinking and to facilitate recovery by surface ship or helicopter. The system will be readily adaptable to all helicopters which are normally used in the 'VERTREP' mission. This work supported by work unit PH102B1.

It is planned to study, analyze, design and test equipment to facilitate recovery of a nuclear weapon or other high value cargo which is separated from a helicopter during vertical replenishment operations over water.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0027, AERODYNAMIC HYSTERESIS

R.D. HERRON, Arnold Research Org. Inc., *Tullahoma, Tennessee* 37389 (DF421053; F40600-77-C-0003)

To document the phenomena of aerodynamic hysteresis known to occur on some aircraft models.

Existing data will be compiled and analyzed to evaluate the observed aerodynamic hysteresis phenomena. Attention will be given to the effects of Mach number, Reynolds number and configuration details.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Arnold Engineering & Development Center

1.0028, SERVICE TRACKING AND EVALUATION OF S-3A GRAPHITE/EPOXY SPOILER
C. FOREMAN, Vought Corporation, Vought Aeronautics Co, *P.O. Box 5907, Dallas, Texas* 75222 (DN781395; N62269-76-C-0439)

To closely monitor the usage and performance of composite structure on fleet aircraft in order to evaluate long-term durability, reliability, and maintenance requirements of composite structure in the Navy operational environment. This work is in support of work unit ZA601, 'Aircraft Technology', Agency Accession No. DN 681080.

Fourteen ship sets of spoilers, fabricated under previous contracted efforts, will be installed on fleet aircraft. A handbook will be prepared for squadron and field service personnel containing inspection requirements, damage criteria, and repair and maintenance procedures. Program progress will be reported quarterly for the first year and semi-annually thereafter. Spoiler ship sets will be periodically removed and shipped to NavAirDevCen for nondestructive and destructive evaluation. Program duration is five years.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0029, NUMERICS GENERATION CONVERSION EQUIPMENT (NGCE) CONVERSION EQUIPMENT
UNKNOWN, Unified Industries Inc., *205 S. Whiting St., Suite 201, Alexandria, Virginia* 22304 (FA77WAI-795; FA160413 (TRAIS NO.))

Revise, rewrite, and correct the existing Numerics Generation Conversion Equipment (NGCE), FA 8953, Instruction Book (IB) TI 6410.13

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0030, HT RM 78-23 - DEVELOPMENT OF AAH SIMULATION MODELS
UNKNOWN, U.S. Army, Applied Technology Laboratory, *Fort Eustis, Newport News, Virginia* 23604 (DA0E3830)

This effort will develop verified simulation models of the limited production advanced attack helicopter using the aircraft reliability and maintainability simulation (ARMS) model. There would be two models: (1) using design R&M values of the AAH and (2) using mature R&M values of the AAH.

AAH reliability, maintenance, and combat damage elements to the component level will be developed for the three levels of maintenance. Verification and parametric analyses will be performed using the ARMS model to isolate the critical support, reliability, and maintainability elements and identify R&D tasks with potential for enhancing the effectiveness of future Army aircraft.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

ASTRONAUTICS

Includes Astronautics (general); Astrodynamics; Ground Support Systems and Facilities (space); Launch Vehicles and Space Vehicles; Space Transportation; Spacecraft Communications; Command and Tracking; Spacecraft Design, Testing, and Performance; Spacecraft Instrumentation; and Spacecraft Propulsion and Power. For Related Information See Also Aeronautics.

2.0001, COMPILATION OF ATS-1, 3, 5, 6 AND CTS USER EXPERIMENTS DOCUMENTATION
N.A. ENGLER, Univ. of Dayton, School of Arts & Sciences, Physics, *300 College Park Ave., Dayton, Ohio* 45469 (NAS 3-21370)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, HIGH RESOLUTION TRANSMISSION ELECTRON MICROSCOPY STUDIES OF ALLOYS
G. THOMAS, Univ. of California, Lawrence Berkeley Laboratory, *Berkeley, California* 94720 (DMR78-03894)

This is a continuation of research on the physical structure of grain boundaries and interphase interfaces, using high resolution electron microscopy, in select aluminum-base alloys and medium carbon high strength low alloy steels. The overall goal is to understand phase transformation phenomena in these metallic materials. A new effort employing scanning transmission electron microscopy (STEM) will provide microdiffraction and microanalytical capabilities to supplement the lattice image work. This is especially helpful for compositional analysis of gradients near boundaries and compositions of intergranular phases, such as retained austenite in martensitic steels. The utilization of lattice imaging and laser optical diffraction for obtaining localized lattice parameter and compositional data will be examined in more detail, especially with regard to theoretical interpretation. This is needed for the research on spinodal alloys and steels, and independent corroboration using STEM will be attempted. The research on steels will be directed toward understanding the lath martensite transformation, interfacial structure, retained austenite stability, and carbide nucleation on tempering. This is a continuation of research previously funded under NSF Grant DMR72-03269 A03. This is the first year of a three year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

3.0002, VALENCE INSTABILITIES AND MAGNETISM
J.M. LAWRENCE, Univ. of California, Graduate School, *Irvine, California* 92664 (DMR76-82109)

There is an intimate connection between the valence instability and the formation of magnetic moments in cerium-based metals. The physics is quite rich, involving valence fluctuations, spin fluctuations and precursive magnetic ordering as well as the many-body interactions reponsible for the valence transition. Experimental studies of the magnetic susceptibility of cerium-thorium alloys will be carried out over a wide temperature range to test for the existence of a characteristic energy for the integral valence state. Susceptibility and thermal expansion measurements will be made in order to examine the relationship between valence instabilities in the intermetallics and in elemental cerium.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

3.0003, COMPOSITE GLASS FIBERS WITH ULTRA HIGH MODULUS
J.D. MACKENZIE, Univ. of California, School of Engin. & Appl. Sci., Materials Engineering, *405 Hilgard Ave., Los Angeles, California* 90024 (NSG 2320)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0004, ELECTRO-DEPOSITION OF III-V COMPOUNDS AND THEIR ALLOYS FROM MOLTEN SALTS WITH SPECIAL REFERENCE LARGE AREA SOLAR CELLS
F.A. KROGER, Univ. of Southern California, School of Letters Arts & Sci., Chemistry, *3551 University Ave., Los Angeles, California* 90007 (NSG 1536)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0005, INVESTIGATION OF THE STRUCTURAL AND ELECTRONIC PROPERTIES OF SMALL METAL PARTICLES

C.K. HEINEMANN, Stanford University, Stanford Lin. Accel. Ctr., *P.O. Box 4349, Palo Alto, California* 94305 (NSG 2326)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0006, CONDUCTIVITY AND CHARGE STORAGE PROPERTIES OF INSULATING MATERIALS

WILKENFELD, Internat. Res. & Tech. Corp., *P.O. Box 80817, San Diego, California* 92138 (DF903240; F19628-77-C-0245)

OBJECTIVE - communications satellites (DSCS) have displayed erratic electronic behavior soon after being placed in orbit. It has been determined that at least some of the observed malfunctions could be due to electrical breakdown in insulating materials caused by charge accumulation from electrons present in the region of the satellite orbits. The objective of this work is to provide information on the electrical conductivity and charge storage properties of insulating materials now used or proposed for use on satellite surfaces. This information will make possible improved satellite designs that minimize malfunctions due to charge build-up.

The electrical conductivity of insulators is a major factor in determining the amount of charge they can accumulate. The environment in which an insulator is located can have a significant effect on its conductivity. The conductivities of the insulators to be tested will therefore be measured under conditions simulating as closely as possible the synchronous orbit space environment. Surface conductivity, on which there is very little information available, will be measured as well as bulk conductivity. The insulators will also be irradiated with electrons simulating those encountered in space to determine the charge storage properties. These charge storage properties will be correlated with the conductivity measurement to enable selection of insulating materials that will minimize charge build up and subsequent electrical breakdown.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

3.0007, ENHANCEMENT OF TITANIUM FATIGUE RESISTANCE

C.M. GILMORE, George Washington Univ., School of Engin. & Appl. Sci., Civil Mechanical & Env Engin, *725 23rd St. N.W., Washington, District of Columbia* 20037 (DN590206; N00019-76-C-0671)

The purpose of this program is to determine metallurgical variables which enhance microstructure stability of titanium alloys (principally Ti-6Al-4V) under fatigue conditions.

The approach in this program is two-fold. First, determine the mechanism that produces longer fatigue lives in solutions treated and quenched alloys and under what environments the resultant microstructures are stable. Second, determine crack initiation and propagation modes by means of inertial friction measurements.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0008, MATERIALS PROCESSING OF HIGH TC SUPERCONDUCTORS FOR SYSTEMS APPLICATIONS

R.A. MEUSSNER, U.S. Navy, Res. Laboratory, *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN680065)

This jointly funded program (ref: WUAS M01-43.801 is to develop to the point of production readiness multifilament V3Ga composite wire for service at higher temperatures, higher magnet fields and with higher current densities than presently available with commercial Nb-Ti wires. It is to develop processes and fabrication procedures which are amendable to commercial production and to fully characterize the superconducting properties of the wires so produced.

The technology developed at NRL for producing single-filament V3Ga wire will be extended to long lengths of high filament density wire. Measurements of the critical current of V3Ga as functions of temperature, magnetic field, and other important engineering parameters will be compared with similar measurements for Nb3Sn. These data will aid in material optimization and provide options for superconducting systems development.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

3.0009, THEORETICAL STUDIES OF ADSORPTION AND RELATED PHENOMENA ON METAL SURFACES

R. GOMER, Univ. of Chicago, School of Physical Sciences, Chemistry, *5801 S. Ellis Ave., Chicago, Illinois* 60637 (DMR77-07723)

A theoretical investigation of adsorption of metals on metals with a view to determining formation of: two dimensional bands as adsorbate concentration increases in the first adsorbed layer, and; three dimensional band formation as layer thickness increases in the multilayer regime. The effect of metallic adsorption on the surface resonance of the tungsten (100) plane which is quenched by some, but not by other metallic adsorbates will be studied. An attempt will be made to formulate a quantum theory of electron impact desorption, extending the semiclassical theory of Menzel and Gomer. The inelastic scattering of atoms from surfaces, both for cases where the interaction potential is weak and where it is strong will be investigated. This is a continuation of research supported by NSF grant DMR-7307589.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

3.0010, SYNTHESIS, STRUCTURE, AND MAGNETIC TRANSITIONS IN TRANSITION METAL COMPOUNDS

R.L. CARLIN, Univ. of Illinois, School of Liberal Arts & Sci., Chemistry, *601 S. Morgan St., Chicago, Illinois* 60607 (DMR76-18963 A02)

Magnetic properties of transition metal ions in oriented single crystals at helium temperatures are being investigated. The primary measurements are zero field specific heats and susceptibilities. In certain cases, field dependence also is measured.

The primary emphasis of this work is the investigation of magnetic ordering phenomena. In addition, paramagnetic properties are examined. One is particularly interested in finding new systems that are simple enough to display the behavior of model systems of phase transitions; highest priority lies with systems that illustrate the properties of the XY model. This laboratory has only recently discovered the first such examples of XY magnets, and has established the ground rules for finding others. The field-dependent properties of XY systems are yet totally unexplored; such studies are planned.

Samples being investigated include: 1) likely XY magnets; 2) systems which act as if they have simple cubic lattices; and 3) series of molecules which offer linear chain structures.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

3.0011, RESEARCH INITIATION - THE EFFECT OF CHLORIDE ON THE HIGH-TEMPERATURE LIQUID PHASE CORROSION OF METALS AND CERAMICS

W.W. LIANG, Univ. of Illinois, Graduate School, *2323 University Hall, Box 4348, Chicago, Illinois* 60680 (DMR77-06480)

The problem of accelerated corrosion of high-temperature materials such as superalloys and ceramics (e.g. silicon carbide and silicon nitride) used as components in fossil-fuel energy producing systems can place serious limitations on the life span and operating efficiency of these systems. The protective qualities of the adherent oxide scales or oxide coatings of these high-temperature materials are destroyed by the liquid salt deposits from the hot combustion gases. Sodium sulfate is found to be the major constituent in the deposits in gas turbines. However, the presence of sodium chloride in the deposits is conceivably due to the short residence time which occurs in gas turbine combustion chambers. In power-generating systems utilizing gasified coal, the likelihood of the presence of chloride in the salt deposits is increased. Therefore, a small amount of chloride present in the liquid surface

deposits may be critical to the hot corrosion process. The principal purpose of this program is to determine the role of chloride present in the liquid sulfate deposits which attack the protective oxides (i.e., alumina, chromia, silica, etc.) on ceramic and metallic materials at high temperatures.

In this study, the 'Acid-Base Hypothesis' will be tested by measuring the activity of sodium oxide in liquid sodium chloride-sulfate mixture as a function of temperature, chlorine potential, sulfur potential and oxygen potential. To understand the mechanism of sodium sulfate-induced hot corrosion, the kinetic properties of the reactions between the protective oxides and liquid sulfate deposits will also be determined.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

3.0012, NAVY VEHICLE DESIGN AND CONSTRUCTION - RESIDUAL STRESS ANALYSIS IN METALS AND ALLOYS
J.B. COHEN, Northwestern University, Technological Institute, Materials Science, *633 Clark St., Evanston, Illinois* 60201 (DN923045; N00014-77-C-0618)

The service life of critical naval components such as gears, bearings, and helicopter blades depends, in part, on the surface residual stresses developed by heat treatment and fabrication. This research is on an improved method for measuring these stresses.

The investigator will develop on x-ray device for measuring residual stresses in metals. A position-sensitive detector will be employed to simplify the procedure. The device will be evaluated by DTNSRDC-Annapolis personnel.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0013, EXCITED ELECTRONIC STATE RELAXATION
K.G. SPEARS, Northwestern University, School of Arts & Sciences, Chemistry, *633 Clark St., Evanston, Illinois* 60201 (CHE77-14668 A02)

Dr. Spears will study energy relaxation processes in excited electronic states of molecules and atoms. The vapor phase relaxation processes include radiationless decay to other electronic states, molecular dissociation and vibrational energy transfer. Additional relaxation processes in solution phase include molecular rotation, molecular ionization, and cage effects on molecular dissociation. The methods of excited state creation will use wavelength tunable lasers in the visible and ultraviolet regions of the spectrum. Laser pulses having variable durations from picoseconds to tens of nanoseconds will provide time resolved probe capability. The probe methods include absorption and fluorescence spectroscopy as well as several types of Raman spectroscopies. This research represents a continuation of that currently supported by Foundation grant CHE-7305256.

SUPPORTED BY U.S. National Science Foundation, Div. of Chemistry

3.0014, DELAYED FAILURE AND AGING OF MELT-SPRAYED CERAMIC-METAL BONDS IN PHYSIOLOGICAL MEDIA
S.D. BROWN, Univ. of Illinois, School of Engineering, Ceramic Engineering, *2527 Hydrosystems Lab., Urbana, Illinois* 61801 (DMR78-18084)

This biomaterials project will deal with delayed failure and aging of ceramic-metal bonds in physiological media. The objective will be to understand the mechanisms which underlie these processes, both in vitro and in vivo. Attention will be focused on the measurement of subcritical crack velocity in plasma-sprayed alumina-coated-metal systems. The effects of the character of the coating-substrate system and the composition of the physiological media on subcritical flaw propagation, aging and delayed failure will be ascertained. Stainless steel and a titanium alloy will be used as substrate materials, and the physiological media to be employed for in vitro experiments will include deionized water and various isotonic saline solutions. The results will be examined in terms of a multibarrier kinetics model of the subcritical crack velocity. Biocompatibility tests will be made in conjunction with in vivo aging experiments. These will involve evaluation of local changes in tissues surrounding the implants by examination of histological sections.

This is a continuation of NSF Grant DMR76-03893.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

3.0015, MATERIALS RESEARCH LABORATORY
J.M. HONIG, Purdue University, School of Science, Materials & Research, *Executive Bldg., Lafayette, Indiana* 47907 (DMR77-23798)

Major interdisciplinary research programs are carried out in four thrust areas: (1) Acousto-Optic and Acousto-Electric Research -parallel development of fundamental research on the generation, propagation, and control of phonons in materials and of engineering applications in bulk and surface acoustic wave devices. (2) Research for Elucidating Transport Phenomena in Well-Characterized Oxides -preparation, characterization, and studies of electronic and ionic structure and transport in metallic oxides. (3) Complex Semiconducting Materials and Their Behavior under Extreme Perturbation - study of the electronic and optical properties of II-VI and III-V semiconductors under extreme conditions of pressure, laser excitation, and high magnetic fields. (4) Interfaces and Heterogeneous Catalysis - theory, preparation, analysis, and applications of ion-surface interactions.

In addition a number of individual projects are carried out under the category of General Materials Research. Support is also provided for upgrading, operation, and maintenance of a range of central facilities with emphasis on materials preparation, optics, and X-ray analysis.

This award is a continuation of DMR76-00889 A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

3.0016, TRANSPORT AND RECOMBINATION PROPERTIES OF LEAD TIN TELLURIDE ALLOYS
K. WEISER, Israel Inst. of Technology, *Haifa, Israel* (DF050450; AF-AFOSR-3509-78)

AF function - secure space communications and cover optical electronics require devices which exploit special properties and interactions of materials with far infrared radiation. Opportunity -infrared materials research has a high potential impact on novel detectors, sources and communications for airborne and spaceborne applications. Objective - this research involves the film growth of lead tin telluride alloy compositions, and characterization and study of fundamental optical properties and electronic structure of these IV-VI compound semiconductors when subjected to tunable C02 laser pulses. How work contributes - the IV-VI semiconducting compounds are potentially useful as infrared detectors in the 8 to 14 micron and 20 to 30 micron ranges of the electromagnetic spectrum. The shorter wavelength interval is the primary spectral region for thermal imagery of terrain and ambient temperature objects, whereas the longer interval is of interest for detecting objects against coldspace backgrounds.

Large single crystal films are produced by unique epitaxial vapor phase techniques. The size, thickness and stoichiometry are more easily controlled and tailored to produce homojunctions, heterojunctions of the same or opposite carrier type, graded energy gap junctions or Schottky barriers without resorting to diffusion processes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0017, FUNDAMENTALS OF DIRECTIONAL SOLIDIFICATION
M.C. FLEMINGS, Mass. Inst. of Technology, School of Engineering, Materials Science & Engin, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DMR78-10905)

This is an advanced phase of a basic investigation on fundamentals of directional solidification. The objective of the current work is to delineate the mechanism(s) responsible for obtaining homogeneous structures in rapidly solidified metals. Secondary objectives are to compare structure fineness and segregation with

existing theory and to delineate areas where extension of existing theory is requied. Materials employed are model alloys of constant partition ratio 'k' (such as Al-Cu alloys) and materials with a retrograde solidus (such as Zn-Cd). Techniques will be employed in achieving rapid solidification (10 to the 4th power - 10 to the 8th power) degrees C/sec) that: (a) require nucleation, such as 'splat cooling', and (b) do not require nucleation, such as 'layer glazing'. Structure and structural homogeneity will be determined quantitatively as a function of cooling rate. Results of critical experiments performed will delineate and distinguish the basic mechanism(s) important for achieving homogeneity. It is hypothesized that one or more of the following mechanisms is responsible for the homogeneity obtained in rapidly solidified metallic materals: (1) depression of the homogeneous nucleation tempeature; (2) nucleation substantially below the liquidus temperature but above the temperature usually assumed to be the homogeneous nucleation temperature; (3) solute building in front of the growing interface; and (4) nonequilibrium interface kinetics. It is expected the results of this investigation will define the specific mechanism(s) and the conditions, necessary and sufficient, to achieve homogeneous structures in select rapidly solidified metallic systems. This program is an extension of research, previously funded by NSF Grant DMR76-21551. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

3.0018, PROPAGATION OF DETONATION THROUGH A NON-UNIFORM HETEROGENEOUS MIXTURE 14417-E

J.A. NICHOLLS, Univ. of Michigan, School of Engineering, Aerospace Engineering, *Ann Arbor, Michigan* 48106 (DA0F8962; DAAG29 77 G0104)

To study experimentally and analytically the propagation of a detonation wave through a heterogeneous mixture which the fuel-to-oxidizer ratio may vary along the path. Relevance - this research will improve the understanding of the influence of fuel/oxidizer ratio and side relief on reactive wave propagation that is required for the development of fuel/air mixtures for munitions. It will further contribute to the studies on pressure instabilities in liquid and solid gun propellant burning.

Liquid fuel drops, all of the same size, will be used and the experimental configuration will correspond to cylindrical geometry. Two different drop sizes will be studied. Distributions of fuel-to-oxidizer ratio with radius which will be examined will include the continuously changing case, the case of uniform ratio except for a void in fuel between radii r sub 1 and r sub 2, and the case of a discontinuity dividing the region into two uniform mixture ratio sections.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0019, NUCLEATE BOILING FROM ION-BEAM TEXTURED SURFACES COATED WITH PLASMA DEPOSITED POLYMERS

H.K. YASUDA, Univ. of Missouri, Graduate School, *103 Parker Hall, Rolla, Missouri* 65401 (NSG 3199)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0020, KINETICS OF METAL ATOM AND METAL FLUORIDE OXIDATION REACTIONS

A. FONTIJN, Aerochem Research Labs. Inc., *P.O. Box 12, Princeton, New Jersey* 08540 (DF047530; F49620-77-C-0033)

AF function - weapons delivery. Deficiency - rocket and aircraft propulsion, including exhaust plumes, are among the Air Force technologies in which progress is hampered by lack of reliable data on some of the basic chemical species and processes, especially those in projected future systems. Objective - in this work, rate coefficients will be measured over a wide temperature range for the reactions of light-metal vapors with specific oxidants. How work contributes - the fundamental reaction rate data obtained will be directly usable in advancing the technologies of afterburners, ramjets and rockets, and their exhaust plume radiation.

The unique capabilities of the aerochem high-temperature fast-flow reactors (HTFFR) will be used to make measurements of reaction rate constants, from as low a temperature as the particular reaction is fast enough to measure, up to dissociation temperature of the molecular reactant. Specific reactions to be studied between metal atoms and gaseous oxidizers are being selected to correspond closely with Air Force technology needs. During the first year, studies of two of the following three reactions may be completed - magnesium and boron with oxygen, and aluminum with nitrogen trifluoride.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0021, DEVELOPMENT OF ALTERNATE SOURCES OF JP-5 FUEL

C.J. NOWACK, U.S. Navy, Air Propulsion Test Center, *Trenton, New Jersey* 08641 (DN796812)

Evaluate the suitability of utilizing JP-5 type fuels derived from coal, oil shale and tar sands for aircraft propulsion systems.

Obtain samples of JP-5 type fuels derived from coal, oil shale and tar sands and establish their properties, chemical and physical characteristics, and evaluate engine and component performance relative to petroleum JP-5 fuel. Establish relationships between synthetic fuel deficiencies and chemical composition of the fuel.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Material Command

3.0022, HIGH-TEMPERATURE, FIRE-RESISTANT TRANSPARENT POLYMERS

R.P. KAMBOUR, General Electric Company, Research & Development Center, *1 River Rd., Schenectady, New York* 12305 (DN790046; N00019-77-C-0311)

To develop a block copolymer of BPF polycarbonate-dimethylsiloxane with an optimum combination of transparency, toughness, thermal stability and fire resistance for evaluation as a high-temperature, fire-resistant glazing material for aircraft.

Synthesize and purify BPF polycarbonate-dimethylsiloxane block copolymer and evaluate for key properties including tg, heat distortion point, tensile properties between -50 and 250 C, abrasion resistance, fire resistance, crazing and transparency.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0023, THEORETICAL INVESTIGATIONS OF THE ELECTRONIC STRUCTURE OF MOLECULES

R.G. PARR, Univ. of North Carolina, School of Arts & Sciences, Chemistry, *Chapel Hill, North Carolina* 27514 (CHE77-22951)

Dr. Parr will carry out theoretical studies to solve diverse problems in molecular structure and conformation. Special emphasis will be given the development of simple models and the development and exploitation of density functional methods, but improvements for both ab initio and semiempirical quantum-mechanical calculation also will be sought. This research represents a continuation of that currently supported by Foundation grant CHE-7504128.

SUPPORTED BY U.S. National Science Foundation, Div. of Chemistry

3.0024, FUNDAMENTAL STUDY OF PRECIPITATES AND THE INFLUENCE OF THEIR CRYSTAL STRUCTURE ON THE STRENGTH OF AGE-HARDENABLE ALUMINUM-LITHIUM ALLOYS

M.L. SHEPARD, Duke University, School of Engineering, Mech Engin, *Durham, North Carolina* 27706 (DA0F9133; DAAG29-78-G-0034)

To study precipitates in the Al-Li and Al-Cu-Li systems over a range of age-hardening conditions. Relevance - it is expectd that, if strength, modulus, ductility, and light weight can be optimized for these alloys, a wide range of Army applications could result in helicopters, bridging, and armored vehicles.

A recently developed chemical extraction method is to be employed for the selective removal of precipitates from the subject alloys. Ternary and quarternary (minor) alloying additions are also to be examined. The extracted precipitates are to be characterized by x-ray analyses. Mechanical properties of the alloys are also to be measured.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0025, FUEL EVALUATION AND DEVELOPMENT
P.C. HAYES, U.S. Air Force, Aeropropulsion Laboratory, *Wright Patt. A.F.B., Dayton, Ohio* 45433 (DF462070)

To evaluate and characterize aircraft fuels produced from petroleum as well as those from sources such as coal liquids and shale oil, to develop and characterize synthetic fuels for specific missile systems, to provide essential support in fuels technology to ASD, operational commands, and other DOD agencies.

State-of-the-art laboratory techniques will be used for characterizing synthetic fuels as well as distillate fuels produced from petroleum, coal and shale oil. Evaluation techniques for characterizing fuels will be developed or improved as needed. Selected materials will be characterized and submitted to other organizations for testing, i.e., AFAMRL and AFML for toxicology and material compatibility testing.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

3.0026, REACTIONS IN LIQUID CRYSTALLINE PHASES
M.M. LABES, Temple University, School of Liberal Arts, Chemistry, *Broad St. & Montgomery Ave., Philadelphia, Pennsylvania* 19122 (DMR77-07811)

Reactions in both liquid crystalline and isotropic phases are studied using a technique in which the kinetics are followed quantitatively via the optical changes in an aligned chiral nematic layer. The possibility of a new type of micropolarimetry is explored by studying quantitatively the texture features of solutions of chiral species in aligned mesophases. Attempts will be made to prepare and study the properties of polymer films containing aligned elliptical pores in the micron size range.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

3.0027, RESEARCH ON REFRACTORY DIRECTIONALLY SOLIDIFIED EUTECTIC COMPOSITES
M.K. THOMAS, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974 (DN833093)

To identify, produce and characterize new high melting point directionally solidified eutectic alloys which show promise for utilization in 2100-2500 F. engine environments.

Optical microscopy will be correlated with data from solidification experiments of candidate high-temperature eutectic systems (2400-3000 F. melting point) to select, produce and characterize a eutectic composite having superior strength/oxidation resistance in a 2100-2500 F. temperature environment. Refractory metal base (CB, Cr) alloys will be explored. Ni, Fe, Co base eutetic alloys have been selected for characterization based on the results of a battelle study sponsored by NavAir.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0028, MOLECULAR BEAM PHOTOCHEMISTRY
R.E. SMALLEY, Rice University, Graduate School, Chemistry, *6100 Main St., Houston, Texas* 77001 (9989-AC5)

Research into the fundamental aspects of photochemistry has traditionally been hampered by (among other problems) an inability to (1) determine the exact nature of the excited state initially produced by light absorption, (2) determine the evolution of these photoactive states in the absence of collisions, and (3) determine the nature, internal excitation, and yield of photofragments which may be the end result of optical excitation. With such problems in mind, it is herein proposed that a supersonic molecular beam provides a remarkably ideal medium in which to study elementary photochemical processes.

The cooling achieved in a supersonic free expansion can be made so extreme that virtually all polyatomic molecules present in the expanding gas are in the lowest available rotational and vibrational quantum state. High resolution laser excitation studies of such ultracold, unperturbed molecules can provide a dramatic increase in our understanding of the excited state structure, time evolution, and ultimate photochemical fate of a wide variety of fascinating polyatomic molecules.

Vitally important in this work are methods which can detect with appreciable quantum yield nonluminescent metastables and photofragments produced by laser excitation of the cold beam molecules. The simple open design and high efficiency of the time-of-flight mass spectrometer suit it well to this task. Mass spectrometry and a variety of other detection techniques combine with high resolution lasers and supersonic beam technology to form a powerful new tool for the study of light-induced molecular transformations and reactions.

SUPPORTED BY American Chemical Society

3.0029, EFFECT OF HIGH PRESSURE ON LAYERED COMPOUNDS
H.T. HALL, Brigham Young University, School of Biol. & Agric. Sci., Chemistry, *B-166 A S B, Provo, Utah* 84601 (DMR76-82421 A01)

It is common practice to describe many types of inorganic crystal structures as layers of close-packed or nearly close-packed atoms. The sequence in which these layers are stacked may be altered by the application of very high pressures. Preliminary experiments have indicated that the variation of stacking sequence with pressure may be predictable by consideration of the relative compressibilities of the constituent atoms. The present investigation is concerned with the effect of very high pressure on the crystal structures of a variety of different binary compounds including those of the AB3 type. The data gained from this work will be used to establish or reject the suggestion that stacking sequence variations with pressure may be predicted from compressibility data.

This is a continuation of work supported by DMR72-03051 and is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

3.0030, ION BEAM SURFACE MODIFICATION - SURFACE ANALYSIS AND ADHESION
D.W. DWIGHT, Virginia Poly. Inst. & St. U., Graduate School, *Burruss Hall, Blacksburg, Virginia* 24061 (NSG 3204)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0031, ENVIRONMENTAL EFFECTS ON ADVANCED COMPOSITES
J. UNNAM, Virginia Poly. Inst. & St. U., Graduate School, *Burruss Hall, Blacksburg, Virginia* 24061 (NSG 1531)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0032, HT PP 78-09 - CERAMIC COMPONENT DEFINITION AND SCREENING (ARMY AIRCRAFT)
J. LANE, U.S. Army, Applied Technology Laboratory, *Fort Eustis, Newport News, Virginia* 23604 (DA0E3812)

Conduct an investigation to assess applicability of ceramics for use in the helicopter gas turbine engine components, reviewing the limitations, design criteria, material properties, etc., required. Use of ceramics offers the potential of a 10 percent decrease in fuel consumption and a 30-40 percent increase in horsepower while reducing engine weight and cost over advanced technology engines for use in future Army helicopters.

To assess suitability of certain ceramic materials for use in Army gas turbine engines, primarily hot section components, by maintaining cognizance of the current programs in ceramics and considering potential benefits and man-rated risks in the helicopter environment. The documentation of this effort will include trip reports, memoranda for record and results of various symposia on the subject.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, SYSTEM INTEGRATION AND FIN DESIGN

B.W. DOUGLAS, U.S. Army, Advanced Syst. Dev. & Mfg. Dir, *Redstone Arsenal, Bldg. 5400, Huntsville, Alabama* 35809 (DA0G1016)

Perform system integration investigations for the free flight demonstration rocket using the Hercules Inc. Strip Laminate Motor. Establish requirements for the fin opening time. Maintain an error budget for the demonstration rocket. Design the shroud and fin assembly.

Conduct system trade-off investigations in accuracy for changes in spin rate, stability margin, delayed opening time of the fins, mallaunch rate, etc. Maintain an error budget with the rocket's sensitivity to each error source. Prepare the technical requirements and monitor an outhouse contract for the design and fabrication of the time delay mechanization package. Design fins and provide fabrication drawings.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Free Flight Rocket Technical Office

4.0002, FLUIDIC FLEX VALUE FOR RAMJET FUEL CONTROL

DJ. SCHAFFER, Signal Companies Incorporated, Airesearch Mfg Co of Arizona, *402 S. 36th St., Phoenix, Arizona* 85034 (DN881114; N62269-77-R-0352)

The basic objectives of this effort are to develop the analytical design criteria for flex-duct valves for high fluid flow applications in general, and to conduct a practical demonstration of a flex-duct valve for a 10,000-pound-per-hour range ramjet fuel control. This contract supports W.U. PH103, Agency Accession No. DN 833162.

Analysis associated with a 500-pound-per-hour fuel metering valve indicated that the receiver rather than the nozzle should be the flexible member in the valve. This analysis will be reviewed again to determine the suitability of this approach for general application. In addition, the following parameters affecting valve design will be studied: duct aspect ratio, recovery nozzle design, flow forces and leakage.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

4.0003, TWO-AXIS IMAGE MOTION COMPENSATION SUBSYSTEM

T.T. MILLER, Hughes Aircraft Company, *Centinela Ave. & Teale St., Culver City, California* 90230 (DN881226; N62269-77-ET7-1805)

Modify far infrared camera (FIRC) system development contract, N62269-76-C-0225 of 1 September 1976, to include the analysis, design, fabrication, integration, performance testing and delivery of a two-axis image motion compensation (IMC) subsystem. This contractual effort supports block work unit ZT701, Agency Accession No. DN781263.

Analyze the vibrational environment of an aircraft-mounted FIRC system design two-axis IMC subsystem utilizing electronic time delay signal processing and compensating mirror techniques. Fabricate IMC subsystem, and integrate subsystem with FIRC system. Experimentally evaluate IMC subsystem performance in a laboratory vibrational environment.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

4.0004, HOLOGRAPHIC LENS DEVELOPMENT FOR FUTURE NAVAL AIRCRAFT

A. AU, Hughes Aircraft Company, Research Labs, *3011 S. Malibu Canyon Rd., Malibu, California* 90265 (DN781222; N62269-76-C-0188)

To demonstrate capability of a holographic lens system and initiated associated material and design improvements. A model holographic lens system will be developed to interface with a P-43 phosphor CRT display. The contract supports work unit ZA601, Agency Accession No. DN681080.

Conduct development of a holographic materials and hologram formation techniques. Investigate and develop special control methods to produce a reflective simulated array hologram sensitized to 5145A (P-43). This continuous lens will be designed to comply with NavAirDevCen specifications for a hologram lens as a design goal.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

4.0005, SURVEILLANCE - OPTICAL DATA PROCESSING

J.W. GOODMAN, Stanford University, School of Engineering, Electrical Engin, *Palo Alto, California* 94305 (DN723645; N00014-76-C-0514)

To improve naval surveillance by the use of novel methods of image formation, image detection and image processing. These techniques may be used in systems for optical imaging through water or through the inhomogeneous atmosphere and for imaging underwater with acoustic waves. Holography is also of interest for information storage and three-dimensional displays.

The simplest method known for performing nonlinear operations is the halftone method. The data to be processed is copied through a halftone screen onto a high gamma film. The resulting halftone transparency consists of an array of transparent windows in an opaque background. By selecting an appropriate diffraction order and using a specially designed halftone screen in the copying process, a multitude of possible non-linearities can be realized. Specific objectives include the development of a better theoretical understanding of the halftone nonlinear process, development of techniques for utilizing bleached halftone transparencies for improved light efficiency, development of halftone screens for use in all optical analogued digital conversion of pictures, and initial investigation of techniques for incoherent optical data processing.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0006, MECHANICAL RESPONSE OF STRUCTURAL ELEMENTS TO DYNAMIC LOADS

G. HERRMANN, Stanford University, School of Engineering, Applied Mechanics, *Palo Alto, California* 94305 (DF050670; AF-AFOSR-3403-77)

AF function - Air Force aerospace vehicles encounter time-dependent external loads during flight. Opportunity - new structural designs emerging as applications of advanced composite materials and bonding techniques provide a new dimension to the study of structural dynamics. Objective - the objective of this research is to study the behavior of new structural concepts and develop theories which can be applied to accurately predict their dynamic response. How work contributes - this research contributes to the science base of structural technology.

This research will consider a number of physical models to study dynamic behavior in differing time regimes. Wave propagation behavior will investigate the propagation of different wave types in laminated composites and bonded structures. Amplitude, phase and dispersion characteristics will be the major quantities of interest in this study. Response of composite structures to moving loads representative of pressure waves will be investigated.

Finally, steady-state and transient response studies will be conducted. In summary, the principal effort will be in extending approximate theories of the effective dispersion theory previously developed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0007, SINGLE CHIP CCD LENSES FOR ULTRASONIC IMAGING
J.D. MEINDL, Stanford University, School of Engineering, Electrical Engin, *Palo Alto, California* 94305 (DF050130; F49620-77-C-0133)

AF function - the maintenance and quality assurance of flight vehicles relies heavily on nondestructive evaluation (NDE) of critical metallic components. Deficiency - there is a deficiency in techniques to specify size, shape and orientation of flaws which initiate catastrophic failure. Objective - the objective of this research is to develop electronic focusing of acoustic field patterns detected by piezoelectric transducer arrays. How work contributes - the monolithic electronic lenses would serve to reduce present ultrasonic imaging system weight, volume, power consumption and cost as much as an order of magnitude. In addition, they would permit improvements in system resolution, field of view, range and frame rate heretofore unfeasible.

Cascade charge coupled device (C3D) integrated circuit analog delay lines will be explored for ultrasonic imaging systems. Various models will be developed to characterize the influence of device technology on lens performance. Theoretical analysis and fabrication methodology will be adjusted to optimize performance.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0008, HIGH POWER MICROWAVE TRAVELING WAVE TUBES
R. AYERS, Varian Associates Incorporated, *611 Hansen Way, Palo Alto, California* 94304 (DN680436)

The objective is to devise and develop better methods to increase microwave power output and frequency coverage of high-power microwave traveling wave tubes used to jam enemy radar missile guidance and fire control equipments. The increased power and frequency coverage is needed to ensure adequate electronic counter-measures protections of our high-value ships and airplanes.

New methods are under investigation for suppression of oscillations in high-power traveling wave tubes in I/J bands by the utilization of reactive reffite mechanisms to provide greatly increased band width capability in high peak.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0009, AIR FORCE THERMIONICS ENGINEERING RESEARCH PROGRAM
E. SHELTON, Varian Associates Incorporated, *611 Hansen Way, Palo Alto, California* 94304 (DF742760; F49620-77-C-0102)

This program is to conduct theoretical and experimental research to revitalize and to sustain a technology base for microwave thermionic devices.

The instructional, theoretical, and analytical capabilities of a leading adacemic center will be brought into close union with a number of qualified industrial laboratories to assure optimum utilization of their combined resources. The university will initiate new concepts as well as infuse new advances from related technical disciplines. Industrial laboratories will provide the facilities for experiment and validation. Air Force function - earlier hoped-for solid-state solutions to requirements now prove deficient in power capability conversion efficiency and economic yield for many microwave requirements. The thermionic solution to needs require improved stability, conversion efficiency, and reduction of life cycle cost, attributes which remain realistic objectives provided that the essential underlying research receives support.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0010, ADVANCED DATA PROCESSING FOR EXPERIMENTS ON BLUFF BODY FLOW
D. COLES, Calif. Inst. of Technology, Graduate School, Aeronautics, *1201 E. California Blvd., Pasadena, California* 91109 (NSG 2319)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0011, DEVELOPMENT AND TEST OF MULTI-ANODE MICROCHANNEL ARRAY DETECTOR SYSTEM
J. TIMOTHY, Univ. of Colorado, Graduate School, *1200 University Ave., Boulder, Colorado* 80302 (NSG 7459)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0012, INVESTIGATION OF A VORTEX MODEL OF THE TURBULENT BOUNDARY LAYER BURST PHENOMENA
J.E. DANBERG, Univ. of Delaware, School of Engineering, Mechanics & Aerospace Engin, *Newark, Delaware* 19711 (NSG 1513)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0013, COMPARISON OF PASSIVE AND ACTIVE MICROWAVE REMOTE SENSING
R.H. LANG, George Washington Univ., Graduate School, *901 23rd St. N.W., Washington, District of Columbia* 20006 (NSG 5288)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0014, RADIATION VULNERABILITY & HARDENING - THEORY
J.B. LANGWORTHY, U.S. Navy, Res. Laboratory, *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN680019)

The objective is to calculate the radiation dose absorbed and the resulting damage to electronic and solid state devices in satellites and missiles caused by radiations from nuclear explosions or natural sources of charged particles (solar or geomagnetically trapped). A second objective is to evaluate the vulnerability of present systems to postulated threats.

Calculations and computer codes will be developed to determine the energy absorbed and damage resulting from various radiations impinging upon different types of electronic and solid state devices of interest to the Navy. A correlation will be made with experimental data wherever possible.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0015, WAVEFORM SENSING FOR STEP MOTOR CONTROL SYSTEMS
B.C. KUO, Univ. of Illinois, School of Engineering, Electrical Engin, *2527 Hydrosystems Lab., Urbana, Illinois* 61801 (ENG75-15220 A01)

This research effort involves an investigation of the various methods of control of incremental motion systems. Optimal and discrete data control theory, computer simulation and experimentation will be applied in the research program to compare the performance of systems that are designed with practical limitations. Since incremental control represents an area of emerging importance, a major portion of the research will be concentrated on this subject. However, the primary objective is to formulate the intermittent control actions of systems utilizing actuators as sample data systems with non-uniform sampling and finite pulsewidth sampling.

This is a continuation of a research effort previously supported under NSF Grant ENG75-15220.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0016, STUDY OF MUTUAL COUPLING BETWEEN TWC ANTENNA SLOTS ON A CONE
S.W. LEE, Univ. of Illinois, School of Engineering, Mech & Industrial Engin, *2527 Hydrosystems Lab., Urbana, Illinois* 61801 (DN890036; N00019-78-C-0064)

Research study to investigate analytical techniques for determining the mutual admittance of antenna slots on a conducting cone.

The theoretical justification of the form of the asymptotic solution for the Green's function of a surface magnetic field, due to a magnetic dipole on a conducting cylinder has not been established, even though it agrees with the modal solution. Justification of this solution will be attempted by critically examining the exact modal solution for a cylinder and extracting rigorous asymptotic solutions of the form of a modified fock solution. This is a necessary step to determining the Green's function for more complex shapes such as cones using geometric theory of diffraction techniques.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0017, STUDY OF AERODYNAMIC MECHANISM FOR NOISE GENERATED BY ROTOR-STATOR INTERACTION
H. ATASSI, Univ. of Notre Dame, School of Engineering, Aerospace & Mech Engin, *Notre Dame, Indiana* 46556 (NSG 3195)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0018, EXPLORATION OF THE POTENTIAL OF FEASIBLE DIRECTION TECHNIQUES COUPLED WITH STRUCTURAL SENSITIVITY ANALYSIS IN LARGE-SCALE OPTIMIZATION
B.L. PIERSON, Iowa State Univ. of Sc. & Tech, School of Engineering, Aerospace Engineering, *496 Town Engineering Bldg., Ames, Iowa* 50011 (NSG 1530)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0019, DYNAMIC SEAL TESTING AND ANALYSIS FOR TURBOPUMP ROTOR DYNAMIC STABILITY AND SYNCHRONOUS RESPONSE TECHNOLOGY IMPROVEMENTS
D.W. CHILDS, Univ. of Louisville, School of Engineering, Mech Engin, *Belknap Campus, Louisville, Kentucky* 40208 (NSG 3200)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0020, TWO-DIMENSIONAL UNSTEADY LAMINAR BOUNDARY LAYERS
K.C. WANG, Martin Marietta Corporation, Martin Marietta Laboratory, *1450 S. Rolling Rd., Baltimore, Maryland* 21227 (DN875029; N00014-77-C-0650)

Unsteady separation which may manifest itself in the dynamic stall of wings and helicopter blades plays a central role in limiting the performance of many aeronautical systems. The proposed research will be directed to the development of a methodology to compute unsteady laminar flows with flow reversal and to apply this methodology to the development of a better understanding of the physics of such flows.

An unsteady, incompressible, laminar boundary layer theory will be developed for the computation of two and three-dimensional flows. Particular emphasis will be placed on the implementation of a technique for treating the proper zones of dependence implicit in the equations so that flow reversal can be studied accurately. An attempt will be made to develop a new criterion for unsteady separation. The initial studies will center about simple geometries such as ellipses and ellipsoids.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0021, EVALUATE THE AUTOMATIC GUIDER SYSTEM FOR POSSIBLE SPACE RANGING APPLICATIONS
D.G. CURRIE, Univ. of Maryland, School of Engineering, Physics & Astronomy, *College Park, Maryland* 20740 (NSG 5287)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0022, LASER SIGNAL TRANSMISSION
D.E. WORTMAN, U.S. Army, Harry Diamond Laboratories, *2800 Powder Mill Rd., Hyattsville, Maryland* 20783 (DA0F5791)

Theoretical analyses will be performed on the interaction of amplitude modulated electromagnetic radiation with liquid drops, and a parallel experimental effort will be initiated to test the theory. The resonance scattering from these drops can be used to determine particle size distributions.

An analysis of the dynamics of a liquid drop will be done similar to that done by Lord Rayleigh. The inclusion of the electromagnetic field will be by way of the quasi-static approximation. Optimum power levels of the laser and the frequency of modulation of the laser will be derived. The initial experiments will be done using visible wavelength lasers, but later experiments will use co sub 2 or other ir lasers since the wavelength will be large compared with the drop size and theoretical-to-experimental comparisons will be more meaningful.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Harry Diamond Lab.

4.0023, STRUT INDUCED AERODYNAMIC FORGING FUNCTIONS
E.M. GREITZER, Mass. Inst. of Technology, Graduate School, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NSG 3208)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0024, HIGH LEVEL PARACHUTE FORCE TRANSFER DEVICE
M. GUSTIN, U.S. Army, Natick Research & Dev. Command, *Natick, Massachusetts* 01760 (DA0H4258)

Establish the design parameters for a coupled height sensor and first-to-second stage deceleration force transfer device for the high level platform airdrop system (HLPADS). The coupled sensor-force transfer device will permit airdrop of heavy equipment from altitudes of 10,000 ft to 25,000 ft above ground level and thereby place the airdrop aircraft out of the range of small surface to air missiles.

Feasibility testing of a complete high level airdrop system using a prototype height sensor-force transfer coupling will be conducted and force data collected to permit establishment of the design parameters.

SUPPORTED BY U.S. Dept. of Defense, Army, Natick Research & Development Command

4.0025, LITHIUM INORGANIC ELECTROLYTE BATTERY INVESTIGATION
M. SLAVIN, General Tel. & Elec. Corp., *189 B St., Needham Heights, Massachusetts* 02194 (DF461350; F33615-77-C-2021)

Provide technology for safe, lithium inorganic electrolyte batteries which meet the performance requirements of life support, spacecraft, and missile silo applications.

Define the conditions and causes of lithium inorganic electrolyte battery explosions. Eliminate the above causes or establish a range of parameters under which safe operation can be achieved. Establish shelf life for both anode and cathode limited cells. Investigate sulfuryl chloride in addition to thionyl chloride as an electrolyte solvent/reactant.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0026, IGNITION AND COMBUSTION IN TUBE FLOW WITH HOT TUBE SURFACE

T.B. SHEN, Southeastern Mass. University, School of Engineering, Mech Engin, *North Dartmouth, Massachusetts* 02747 (DF051530; AF-AFOSR-3538-78)

AF function - weapon delivery, and defense, transport, aircraft fire safety, vulnerability and survivability in accident and combat situations. Deficiency - insufficient understanding of basic physical, chemical and fluid dynamic processes of ignition of combustible fuel-air mixtures by hot surfaces. Objective - to theoretically model the ignition of fuel sprays by hot surfaces. How work contributes - will provide theoretical models not presently available for the ignition by hot surfaces of combustible substances, will improve hazard assessment for both accidental fires and fires caused by combat damage, and in general, contribute to reducing aircraft vulnerability and survivability.

A theoretical model of hot surface ignition of combustible fuel-air mixtures in flat plate boundary layer flow will be modified for tube flow and extended to include both laminar as well as turbulent flows. To perform this analysis, a set of conservation principles in cylindrical coordinates will be treated numerically. Local and instantaneous information about velocity, temperature and concentration variables will be calculated. The instance of the ignition will be identified. The spread of the combustion wave will also be studied. Various integral parameters, such as ignition delay time, the blow-off limit, non-ignition limit, etc., will be deduced. The roles of various control parameters, such as the flow Reynolds number, tube wall temperature, the fuel gas flow rate, the fuel gas initial concentration, gas temperature, fuel type, etc. will be systematically studied. Calculated results will be used to compare experimental measurements and to validate the theoretical model in a follow-on program at AFAPL.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0027, RAMAN LIDAR FIELD TESTS

D. LEONARD, Computer Genetics Corporation, *4 Lake Side Office Park, Wakefield, Massachusetts* 01880 (DN781308; N62269-76-C-0302)

TECHNICAL OBJECTIVE: To demonstrate accurate correlation of raman lidar, microwave radar and radiosonde measurements and obtain data necessary to validate ray tracing models. This contract supports Work Unit RG704, Agency Accession No. DN 681244.

APPROACH: Field tests will be performed at NASA-Wallops Island facility, utilizing a government owned colocated lidar and microwave radar set.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

4.0028, HYPERSONIC HEAT TRANSFER TEST SUPPORT PROGRAM

V. DICRISTINA, Avco Corporation, *201 Lowell St., Wilmington, Massachusetts* 01887 (DF051170; F49620-78-C-0029)

AF function - aerospace vehicles. Deficiency - unpredicted or poorly predicted transition from laminar to turbulent flow on the nose tips of ABRES shapes has caused numerous severe problems of heating and aerodynamic instability. Ground based flow facilities do not simulate all of the flow parameters of free flight that influence these phenomena. One facility, which is rather economical to operate, located at the VKIFD, Brussels, is capable of simultaneous simulation of Mach number and Reynolds number of these flights, while not achieving the sustained, realistic running time. Nevertheless, heat transfer and pressure distribution measurements on a number of nose tip shapes of interest to ABRES appears to be desirable. Objective - to extend and confirm data previously obtained by VKIFD with AVCO support and coordination. How work contributes - the results will help with design of nose tips which ameliorate the problems alluded to under deficiency.

AVCO will supply the model(s) and instrumentation and will coordinate the test schedule with AFOSR and SAMSO to assure that the most appropriate possible measurements are made. VKIFD will run the experiments in the longshot facility. Resulting data will be given to AVCO for analysis, as well as undergoing analysis at VKIFD.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0029, THEORY AND COMPUTATION OF SINGULAR OPTIMAL CONTROLS

W.F. POWERS, Univ. of Michigan, School of Engineering, Aerospace Engineering, *Ann Arbor, Michigan* 48106 (ENG77-16660)

This research deals with problems, such as the choice of the trajectory for the space shuttle, in which use of fuel or similar resources must be minimized. The principal investigator deals with the theory and the computational practice of the treatment of such problems and of the special difficulties (the so-called 'singularities') that must be overcome in their solution. It is an unusually successful and useful line of research.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0030, A PANEL METHOD BASED ON LOCALIZED SPLINES

J.P. MORAN, Univ. of Minnesota, School of Engineering, Mechanics & Aerospace Engin, *105 Morrill Hall, Minneapolis, Minnesota* 55414 (NSG 2316)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0031, ROCKET STUDY OF AURORAL PROCESSES

R.L. ARNOLDY, Univ. of New Hampshire, School of Engin. & Phys. Sci., Physics, *Durham, New Hampshire* 03824 (NSG 6022)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0032, NAVY VEHICLE DESIGN AND CONSTRUCTION - FLUTTER OF AXIAL-TURBOMACHINE BLADING

F.A. SISTO, Stevens Institute of Technol., School of Engineering, Mech Engin, *Hoboken, New Jersey* 07030 (DN923286; N00014-76-C-0540)

This research covers theoretical analysis and experimental measurements of self-excited and forced vibration aspects of typical gas turbine compressor blading. Such vibration, 'blade flutter', leads to gross mechanical behavior problems and to failure in meeting full design requirements for aircraft jet engines. Hence, this research contributes to assuring optimum jet engine performance at maximum rated power, and hopefully to increased life and reliability of military engines.

The investigation aims at acquisition of accurate experimental blade flutter data from annular cascade rigs incorporating suitable test sections, blowing equipment and variable guide vanes and blading. The many geometric, aerodynamic, vibratory parameters affecting nonstationary aerodynamic lift and moment coefficients are considered. A rotor rig is nearing completion which will have greater accuracy (vs a strator rig) in procurement of aeroelastic data.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0033, DIELECTRIC GRATINGS WITH ARBITRARY PROFILES
T. TAMIR, Polytechnic Inst. of New York, School of Science & Engin., Electrophysics, *333 Jay S.., Brooklyn, New York* 11201 (ENG77-28317)

Recent advances in integrated-optics components that incorporate periodic structures have led to increased interest into the electromagnetic (optical) behavior and waveguiding properties of dielectric gratings. However, systematic guidelines for the construction of gratings whose performance complies with given specifications have not yet been formulated. By applying a new approach to the electromagnetic problem posed by optical gratings new design criteria are being developed. This approach combines approximate and exact analytic tools with an equivalent-network representation of the grating configuration. Such a network representation describes the grating operation in terms of electrical sources whose role yields physical insight into the effects produced by the various grating parameters. A synthesis procedure for the realization of gratings having specified performance characteristics is being formulated.

An important aspect of the proposed study is that it will deal with gratings having arbitrarily asymmetric profiles, which enhance directional discrimination, or 'blazing', of the scattered wave.

This research was previously supported under NSF Grant ENG74-23908.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0034, TIME-OF-DAY EFFECTS ON THE NUMERICAL REPRESENTATION OF COMMUNITY RESPONSE TO NOISE
E. GALANTER, Columbia University, School of Arts & Sciences, Psychology, *Broadway & W. 116th St., New York, New York* 10027 (NSG 1550)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0035, EXPERIMENTS OF JET MIXING IN COMPACT REVERSE FLOW COMBUSTOR CONFIGURATIONS
I. GREBER, Case Western Reserve Univ., School of Engineering, Fluid Thermal & Aerospace Sci, *University Cir., Cleveland, Ohio* 44106 (NSG 3206)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0036, EXPERIMENTAL INVESTIGATION OF SHOCK-WAVE-BOUNDRY LAYER INTERACTION
I. GREBER, Case Western Reserve Univ., School of Engineering, Fluid Thermal & Aerospace Sci, *University Cir., Cleveland, Ohio* 44106 (NSG 3211)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0037, THE DEVELOPMENT OF SENSORS AND TECHNIQUES FOR IN SITU WATER QUALITY MONITORING
C.C. LIU, Case Western Reserve Univ., Graduate School, *2040 Adelbert Rd., Cleveland, Ohio* 44106 (NSG 3203)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0038, SHADED COMPUTER GRAPHIC TECHNIQUES FOR VISUALIZING AND INTERPRETING ANALYTIC FLUID FLOW MODELS
F.I. PARKE, Case Western Reserve Univ., Graduate School, *2040 Adelbert Rd., Cleveland, Ohio* 44106 (NSG 3207)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0039, ADAPTIVE ANTENNA ARRAYS FOR AIRCRAFT COMMUNICATIONS
T. COMPTON, Ohio State University, School of Engineering, Electrical Engin, *190 N. Oval Dr., 102 Administration Bldg., Columbus, Ohio* 43212 (DN790000; N00019-77-C-0156)

The objective of this program is to investigate techniques for using adaptive antenna concepts appropriate for use in conventional airborne military communication systems to reduce or eliminate signal interference.

Concepts for adding recognition characteristics to conventional amplitude modulated (AM), frequency modulated (FM), frequency shift keying (FSK) and single sideband (SSB) modulated systems which will not increase the bandwidth of such systems will be investigated. For AM and FM systems primary emphasis will be placed on the possibility of using phase coding techniques for recognition of desired signals. For FSK and SSB systems other coding concepts will be explored.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0040, ION-ATOM AND ION MOLECULE CHARGE TRANSFER REACTIONS
E.G. JONES, Wright State University, Graduate School, *Dayton, Ohio* 45431 (DF462000; F33615-77-C-3141)

To measure the cross-sections for the production of excited Xe plus and Kr plus in reactions between the dimer ions He2 plus and Ar2 plus and the neutral species Kr and Xe.

Perform an initial survey to determine which of the above reactions have the largest cross-sections. Those reactions shown to be most significant will have more refined measurements made of their cross-sections. The energy dependence of selected cross-sections may then be made at the discretion of the project engineer.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0041, MODULAR AVIONICS PACKAGING
J. MCNAMARA, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974 (DN881145)

To develop an integrated avionics rack design and an aircraft avionics installation concept which minimizes the installed avionics weight, and optimizes thermal efficiency.

An in-house effort will develop and analyze integrated rack concepts in support of a contracted effort administered by NAFI (NavAvionicsFac). In-house efforts will address application of the following technologies: lightweight environmental control system, advanced aircraft electrical system, composite structures.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Avionics Facility

4.0042, MEASUREMENTS ON AN IMPROVED PERFORMANCE WALL JET CONTROL FOR TURBULENT BOUNDARY LAYERS
R.L. SIMPSON, Southern Methodist University, School of Engin. & Appl. Sci., Electrical Engin, *Hillcrest & University, Dallas, Texas* 75275 (NSG 1548)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0043, A ROCKET PROGRAM IN AERONOMY
A.B. CHRISTENSEN, Univ. of Texas, Graduate School, *Dallas, Texas* 75230 (NSG 6023)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0044, FLUID DYNAMICS OF CRYSTALLIZATION FROM VAPORS
F.E. ROSENBERGER, Utah Higher Education System, School of Engineering, Materials Science & Engin, *1400 E. 2ND S., Salt Lake City, Utah* 84112 (NSG 1534)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0045, ACTIVE DAMPING OF MODAL VIBRATIONS BY FORCE APPORTIONING
W.L. HALLAUER, Virginia Poly. Inst. & St. U., School of Engineering, Aerospace & Ocean Engineering, *Burruss Hall, Blacksburg, Virginia* 24061 (NSG 1526)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0046, IMPROVED MODELING AND SOLUTION PROCEDURES FOR NONLINEAR ANALYSIS
M.P. KAMAT, Virginia Poly. Inst. & St. U., School of Engineering, Engineering Sc & Mech, *Burruss Hall, Blacksburg, Virginia* 24061 (NSG 1546)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0047, MULTIVARIABLE DIGITAL CONTROL
J.S. MEDITCH, Univ. of Washington, School of Engineering, Electrical Engin, *206 Guggenheim Hall, Seattle, Washington* 98105 (ENG78-02398)

The research is in the area of digital control for stochastic multivariable systems with adjustable plant parameters. The problem is addressed from the viewpoint of the servomechanism looking at the minimum mean-square error in tracking command inputs and rejecting disturbances subject to inequality mean-square constraints on plant inputs to prevent saturation. The adjustable plant parameters are incorporated directly into the control problem formulation. The objective of the research is the development of necessary and sufficient conditions for the existence, and procedures for the realization, of digital feedback controllers which operate only on the available system error signal. The theoretical results will be illustrated with applications involving gas turbines, multi-generator power systems and aircraft flight control.

This is a continuation of research initiated under ENG-73-03792 (A02) at the University of California (Irvine).

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

GEOSCIENCES

Includes Geosciences (general), Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, THE APPLICATION OF REMOTE SENSING TECHNOLOGY TO SOIL MAPPING AND LAND USE PROBLEMS OF ALABAMA AND SOUTHEASTERN UNITED STATES
O.L. MONTGOMERY, Alabama Agric. & Mech. Univ., School of Agriculture, Natural Resource & Env Studies, *Normal, Alabama* 35762 (NSG 8062)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0002, URANIUM IN ALASKA
T.P. MILLER, U.S. Dept. of The Interior, Geological Survey, Geologic Division, *1209 Orca St., Anchorage, Alaska* 99501 (8-9440-01681)

STATES TO WHICH PROJECT PERTAINS: Alaska.

The current fiscal year objectives are to complete reconnaissance studies in the Melozitna and Bettles quadrangles. Particular emphasis will be given to the large uraniferous plutons that occur in both quadrangles. Studies will be helicopter-supported and will consist of mapping plus petrologic and geochemical sampling.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0003, RELATIONSHIP BETWEEN THE RING CURRENT AND MAGNETOSPHERIC SUBSTORMS
S. AKASOFU, Univ. of Alaska, School of Arts & Sciences, Geophysics, *Fairbanks, Alaska* 99701 (NSG 7447)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0004, RARE EARTHS IN INCLUSIONS FROM DIFFERENT CLASSES OF CARBONACEOUS CHRONDITES
W.V. BOYNTON, Univ. of Arizona, Graduate School, *Tucson, Arizona* 85721 (NSG 7436)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0005, MEASUREMENT AND FORECASTING OF SOIL MOISTURE BY REMOTE MEANS
D.D. EVANS, Univ. of Arizona, School of Earth Sciences, Hydrology & Water Resources, *Tucson, Arizona* 85721 (NSG 5279)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0006, REMOTE SENSING OF OCEAN POLLUTANTS
D.A. WALSH, Univ. of Southern California, Ethel Percy Andrus Geront. Ctr, *3551 University Ave., Los Angeles, California* 90007 (NSG 1528)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0007, REMOTE SENSING APPLICATIONS TO ALUNITE RESOURCES, NEVADA
R.P. ASHLEY, U.S. Dept. of The Interior, Geological Survey, Geological Division, *345 Middlefield Rd., Menlo Park, California* 94025 (9320-01941)

STATES TO WHICH PROJECT PERTAINS: Nevada.

The main effort will be to estimate the amounts of kaolinite and alunite present at many localities sampled in the Cuprite mining district, Nevada, and to examine the characteristics of aircraft scanner data and field spectrometer data for the 0.4-2.5 mm spectral region at the same localities. The objective is to develop a semiquantitative tool for mapping variations in total alunite/clay content in hydrothermally altered rocks, using aircraft scanner images for spectral bands at 1.6 and 2.2 mm. Comparison of petrographic data with field spectral reflectance data should reveal relations between mineral abundance and spectral characteristics that can be applied to use of any scanner system.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0008, INSTRUMENT MAINTENANCE
C.B. EMMANUEL, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (8G172253)

PROJECT OBJECTIVE: Maintain and calibrate instrumentation used for environmental research primarily on Reseach Facilities Center aircraft. (Radar, cloud physics, remote sensing, etc.).

CURRENT YEAR PLAN: Develop calibration and maintenance capabilities for both the sensors and data acquisition systems aboard the RFC aircraft. Provide calibration of the aircraft sensors both on the ground and in the air (intercomparison with instrumented towers, other aircraft) in support of approved research programs.

PROGRESS REPORT: A limited number of calibration equipment has been purchased. Initial calibration (intercomparison) of all three aircraft with an instrumented tower has been completed. The support available, however, has not been commensurate with the calibration requirements of the aircraft systems.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs.

5.0009, THEORETICAL STUDIES OF PLANETARY ATMOSPHERES

G.E. THOMAS, Univ. of Colorado, Lab. for Atmos. & Space Physic, *1200 University Ave., Boulder, Colorado* 80309 (ATM76-23812 A01)

This grant funds a study of the radiative processes which determine the thermal structure of the middle atmospheres of the planets, particularly the stratosphere and mesosphere of Earth. The initial emphasis will be on developing general theoretical methods for calculating the time-dependent properties of temperature and density, as they are affected by changing solar ultraviolet heating, or by impulsive or harmonic disturbances due to dynamical processes. Specific applications will be made to the diurnal temperature variation of the middle atmosphere, to the coupling of photochemistry to radiation, and to the effects of non-LTE on the thermal emission. In addition, this grant funds a study of the structure of the outer hydrogen exosphere of Earth and the planets. This will be achieved both by analysis of satellite measurements and through a dynamical theory of the interaction of the exosphere with solar radiation. It is planned to conduct a detailed study of the behavior of atomic hydrogen in the upper thermosphere during a geomagnetic storm, from an analysis of Lyman alpha airglow data and from a dynamical theory of a time-dependent exosphere.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0010, PLANNING THE MONEX/OCEANOGRAPHY PROGRAM

D.W. MOORE, Nova University, Physical Oceanographic Lab., *800 N. Ocean Dr., Dania, Florida* 33004 (ATM76-80605 A01)

The purpose of this grant is to continue to provide funds for the planning segment of the oceanographic component of the Monsoon Experiment (MONEX). This will include continued support of the MONEX/Oceanography Project Office (previously called the Indian Ocean Experiment (INDEX) Office) at Nova University and meetings of the MONEX/Oceanography Organizing Committee (previously called the INDEX Organizing Committee). The INDEX, a pilot research project that was conducted during FY 1975-1977 has successfully developed the oceanographic part of MONEX and so the program is now called MONEX/Oceanography.

The MONEX is a major study to increase our knowledge and understanding of the dynamics and thermodynamics of the atmosphere and the ocean in monsoon regions. The major objective of MONEX/Oceanography is to understand the time-dependent response of the Indian Ocean to the wind forcing due to the monsoons, and the nature of the feedback that the ocean produces on the monsoon regime itself. MONEX is important scientifically and also has significance for global agriculture, economics and politics. The NSF is responsible for supporting the costs of research, logistics, equipment and management of U.S. participation in MONEX which is a regional subprogram under the Global Atmospheric Research Program (GARP).

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0011, PHYSIOGRAPHIC CLASSIFICATION OF SOUTHERN PINE FOREST LANDS

W.H. SMITH, State University of Fla. Sys., School of For. Resour. & Cons., *Gainesville, Florida* 32601 (0060699; FLA-FY-01586)

OBJECTIVE: Organize physiographic land patterns into a system having significance and utility for resource managers. Develop a physiographic map of southern region using the new system.

APPROACH: Current information on physiography, soils, and surface geology related to forest vegetation will be analyzed and coordinated. Localized information will be reorganized to form a unified regional system. Map development will be on a state basis, utilizing authorities, aerial photography, and space imagery when appropriate.

PROGRESS: Continued to provide resource information to Auburn University, Dr. Earl Hodgkins, for compilation physiographic information into a map format.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, Florida

5.0012, OBSERVATION AND STUDY OF FLORIDA CONVECTIVE STORMS

R.M. LHERMITTE, Univ. of Miami, School of Marine & Atm. Sci., Meteorology & Physical Oceanog, *4600 Rickenbacker Causeway, Miami, Florida* 33149 (ATM77-07982 A01)

This research program is directed towards the understanding and study of thunderstorm circulation physics and dynamics and will include two experiments both to be conducted at the Kennedy Space Center during summer 1977 and 1978. It includes the interpretation of the motion fields observed inside thunderstorms by a network of two or three Doppler radars.

The first objective of the research effort is to achieve an adequate three-dimensional description of (1) motion fields (and associated parameters such as convergence and vorticity), (2) radar reflectivity (leading to precipitation intensity and precipitating liquid water content), and (3) mean terminal velocity of the precipitation particles if allowed by the availability of a third radar.

The next objective is the interpretation of these three-dimensional fields to specify the significance and importance of the processes involved in the development of convective storms such as storm circulation, intensity, the formation and evolution of precipitation, the production and dissipation of electricity, etc., so that a descriptive model of the convective storm would be achieved.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0013, COMPREHENSIVE STUDY OF POSSIBLE SOLAR ACTIVITY INFLUENCE ON THE UPPER STRATOSPHERE AND MESOSPHERE

C.G. JUSTUS, Georgia Inst. of Technology, School of Engineering, Aerospace Engineering, *225 North Ave. N.W., Atlanta, Georgia* 30332 (ATM77-05967)

This grant funds a study of possible influences of solar activity on the upper stratosphere and mesosphere (25-90 km). The indices of solar activity whose possible influences will be studied are: 1) the AE index, a measure of global electrojet activity, 2) the magnetic storm index Dst, 3) the solar radio noise flux at 10.7 cm wavelength F 10.7, 4) the 1000 A to 3500 A UV flux as measured by satellite, 5) the 1 A to 20 A X-ray flux as measured by satellite, 6) solar proton flux as measured by satellite, 7) solar magnetic sector boundary crossings, 8) solar magnetic sector intensities, 9) the Zurich sunspot number, and 10) and the satellite measured near-earth cosmic-ray flux (to investigate potential effects of solar magnetic field modulations on cosmic-ray flux and resultant influence on ionization). The meteorological parameters of the 25-90 km altitude region whose possible influence by solar activity is to be studied are: 1) departures of measured temperature, density, pressure, zonal wind, and meridional wind from 'climatological' monthly means, 2) the magnitude of gravity waves and planetary waves, as deduced by the daily difference analysis method, 3) weekly stratospheric circulation index and thickness values for the 30 degrees to 70 degrees latitude area between pressure heights to 5 mb and 0.4 mb.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0014, LAND RESOURCES INVENTORY AND INFORMATION RETRIEVAL SYSTEM FOR WESTERN ILLINOIS
J.A. NELSON, Univ. of Illinois, Agric. Experiment Station, *Urbana, Illinois* 61801 (0069401; ILLU-01-0350)

OBJECTIVE: Inventory land resources in 10-county Title V project area at a scale meaningful for local decision-making; determine suitability of land for alternative uses (agriculture, conservation or preservation, recreation and open space, and urbanization); deliver a usable system of factual and interpretive data to provide local officials with information useful in land use decisions.

APPROACH: Data to be gathered by field groundwork, low-level aerial photography, high level photography, and remotely sensed imagery (ERTS). Preparation of maps and tabular information with descriptive narrative. Western Illinois University is cooperating institution.

PROGRESS: The comprehensive land resources inventory will provide planners and other officials with data necessary to formulate land use policy in cases where the physical resources will be threatened, altered, or otherwise utilized for agricultural, industrial, recreation, or residential activities. For many of the sample western Illinois counties, this is the first time land use data have been compiled systematically. The data is being produced in the form of manuals, maps, and a computerized information retrieval system. An atlas of current resource uses in the ten-county target area of western Illinois is being developed in an attempt to describe in detail current trends or patterns in land use. Land use suitability manuals (one for each county) will emphasize the most effective uses land areas can be put to in the future. The computerized information system will be interactive and can be easily accessed by lay people unfamiliar with computer technology. It is anticipated that the system could be heavily used by planners, government officials, and citizens alike in order to create a more orderly and effective plan of growth for western Illinois. Applications to statewide and national land use planning are hoped for outcomes.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, Illinois

5.0015, TURBULENCE MEASUREMENTS IN MARINE FOG
J.B. RUSSELL, U.S. Navy, Avionics Facility, *Indianapolis, Indiana* 46218 (DN597002)

To determine the influence of turbulent transport in the atmospheric surface layer on the formation, maintenance, and dissipation of marine fog.

To participate in field investigations at sea during which measurements of the turbulent fluctuations of wind, temperature, and water vapor are made. In addition, measurements of mean meteorological parameters are made. Hot wire and hot film anemometers are used to measure turbulent fluctuations of wind. Cold platinum wires are used to measure turbulent fluctuations of temperature. An attempt is being made to use the measurements of turbulent fluctuations of microwave refractive index using a microwave refractometer to estimate fluctuations in atmospheric water vapor. An indirect approach is used to estimate turbulent fluxes by obtaining spectra of the turbulent parameters, using kolmogorovs' similarity hypotheses, and assuming a balance between generation and dissipation of turbulence.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

5.0016, POLLUTION MONITORING BY TURBIDITY AND SEDIMENT EXAMINATION
K.H. LENZEN, Univ. of Kansas, School of Engineering, Civil Engin, *Learned Hall, Lawrence, Kansas* 66044 (NSG 1533)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0017, DEVELOPMENT AND APPLICATION OF PHOTOGRAPHIC TECHNIQUES OF REMOTE SENSING
G. COOPER, Univ. of Maine, Agric. Experiment Station, Botany & Plant Pathology, *36 Winslow Hall, Orono, Maine* 04473 (0071745; ME08494)

OBJECTIVE: Explore the use and efficiency of photographic remote sensing in low intensity soil surveys. Develop the use of aerial photographic ocean and estuary surveys on the Maine Coast. Accumulate, as a result of ongoing research, material for a remote sensing atlas of Maine's herbaceous vegetation. Explore various aspects of disease problems in apples and blueberries using aerial photographic techniques.

APPROACH: All objectives are being explored using existing research land and personnel. All photography is low level and intended to expand the work already underway. Except for underwater detail, as in objective 2, the work is concentrated on the use of black and white and color infrared imagery.

PROGRESS: Early winter remote sensing data on soil typing the University Forest (in cooperation with S.C.S.) acquired, now being analyzed. Preliminary color infrared survey of selected blueberry field plots finished. Results are encouraging and have stimulated ground work by research personnel working with blueberries. Final survey of poultry manure pasture plots accomplished. Evidence of migration of fertilizer outside plots evident. Forage plots on Rogers farm (release of alfalfa by herbicidal treatment) finished. Results excellent. Effects of release well shown. Bottom of estuary survey - inactive this year due to changing research workers on ground truth data acquisition. Cooperative agreement and funding (with Department of Environmental Protection) on solid waste disposal site research finalized.

SUPPORTED BY Maine State Government

5.0018, COMPARATIVE GEOCHEMICAL AND PETROLOGICAL STUDY OF LUNAR AND TERRESTRIAL BASALTIC VOLCANISM
J.M. RHODES, Univ. of Massachusetts, School of Arts & Sciences, Chemistry, *Amherst, Massachusetts* 01002 (NSG 9069)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0019, SATELLITE DENSITY SYSTEMS
C. ACCARDO, Epsilon Laboratories Inc., *Bedford, Massachusetts* (DF580470; F19628-77-C-0062)

AF function - low altitude operational satellites, airborne surveillance, ballistic nuclear weapon delivery. Deficiency -inaccuracies in spacecraft's orbital track and trajectories due to insufficient knowledge of atmospheric density variability at critical altitudes. Objective - acquisition of atmospheric density measurements, define, analyze, correlate and relate results to solar and geophysical phenomena. How research contributes - permits direct accurate measurements of density providing inputs needed in the development and upgrading of forecasting techniques.

Instrumentation using ionization gauges along with a motor activated air stream modulator has been developed for use onboard the S77-2 spacecraft. These flight units are capable of measuring directly atmospheric density and also potentially atmospheric temperature and spacecraft altitude.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0020, DEVELOPMENT OF NEW TECHNIQUES FOR SOON MEASUREMENTS
H.L. DEMASTUS, U.S. Air Force, Geophysics Laboratory, *L.G. Hanscom A.F.B., L.G. Hanscom A.F.B., Bedford, Massachusetts* 01730 (DF580790)

AF function - communications, surveillance, detection, tracking. Deficiency - inadequate knowledge of solar environment, disturbances, and physics limits ability to predict events which disrupt and degrade AF systems. Objective - to improve present techniques and develop new ones for the collection and interpretation of magnetic data from the solar observing optical network (SOON) in order to generate better predictions of solar-

induced geomagnetic disturbances. How research contributes - when completed, SOON will provide the only continuous coverage of solar acitivity in the optical wavelength region. To maximize the potential of SOON for reliable flare prediction, techniques must be perfected for extracting the required data from these telescopes in a highly efficient manner. The air weather service, which is responsible for accurate disturbance forecasts, depends on PHS for technical expertise and guidance in the operation of SOON.

Technique development will include improved computer algorithms, theoretical analyses, both by contractors and by IHWU 2311G309 under this task, and new hardware for the study of active region magnetic and intensity fields. Some of the hardware will be built by contractors. It will be of an experimental nature and feasibility studies will be conducted on existing SAC peak telescope, prior to attempting modifications of SOON to incorporate these features. Data from SOON, SAC peak and other instruments will be used in these studies. Close cooperation with AWS is anticipated in data gathering, archival, and distribution. PHS will coordinate scientific efforts between AWS and the outside solar physics community. A CWU 'sunspot dynamics' will report on conditions in sunspot regions which may lead to flares.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0021, TWENTY KILOMETER TETHERED BALLOON

J.F. DWYER, U.S. Air Force, Geophysics Laboratory, *L.G. Hanscom A.F.B., L.G. Hanscom A.F.B., Bedford, Massachusetts* 01730 (DF580640)

AF function - advanced high-altitude tethered balloon system for surveillance, monitoring, environmental research and space vehicle testing. Deficiency - current tethered balloon technology is limited to altitudes less than 6 kilometers. Objective - the ability to deploy and maintain a tethered balloon at an altitude of approximately 20 kilometers will be demonstrated. How research contributes - the envisioned flight will prove the feasibility of long duration, on station high-altitude platforms to support the stated Air Force functions.

A non-aerodynamically shaped balloon equipped with 15 staged de-reefing points has been designed and fabricated to permit tethered ascent with minimized balloon drag. The tethered flight of this balloon will be accomplished using a 7000 pound break strength nylon-jacketed Kevlar cable in conjunction with a hydraulic tether winch capable of outhaul at 1000 feet per minute. Studies of the operational environment will be undertaken to develop a flight strategy and these, combined with post flight performance analyses, will form the basis for the documentation of recommendations for further high-altitude tethered balloon developments.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0022, SPECTROMETER FOR ULTRAVIOLET HORIZONS MEASUREMENT

R.E. HUFFMAN, U.S. Air Force, Geophysics Laboratory, *L.G. Hanscom A.F.B., L.G. Hanscom A.F.B., Bedford, Massachusetts* 01730 (DF581310)

AF function - spacecraft guidance and control, target detection and tracking, surveillance. Deficiency - insufficient information on ultraviolet horizons to develop horizon sensors. Objective -development of a spectrometer to measure the ultraviolet horizon from a satellite or shuttle, including altitudinal variation, global variation and spectral characteristics. How research contributes - the radiance from the earth's atmosphere as a function of the viewing direction is the primary measurement required to develop improved horizon sensors for spacecraft altitude control. The stability, spectra, and intensity will be obtained from the experiment obtained under this work unit.

The horizon limb profiles will be measured in the ultraviolet and vacuum ultraviolet wavelength regions using small spectrometers. These Ebert-Fastie spectrometers will allow the necessary wavelength band discrimination. A telescope will isolate a small field of view. Prototype units will be tested in regard to sensitivity as a function of wavelength and irradiation direction. A group of these modules will be incorporated into a satellite or shuttle experiment.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0023, DEVELOPMENT OF NONLINEAR INVERSION TECHNIQUES

J.I. KING, U.S. Air Force, Geophysics Laboratory, *L.G. Hanscom A.F.B., L.G. Hanscom A.F.B., Bedford, Massachusetts* 01730 (DF581040)

AF function - provide global atmospheric temperature and humidity structure for military operations. Deficiency - current thermal and moisture retrieval techniques from DMSP satellite data are defective. Objective - to develop an optimal inversion technique capable of extracting all the information regarding atmospheric structure inherent in the DMP sounder data. How research contributes - provides a method whereby all accessible information is obtained as well as discriminating against bias subjectively introduced into retrieval scheme.

Nonlinear inversion has the attractive features of objectivity (no 'first-guess', prognosis, or climatological input is needed and noise discrimination (data noise is inferred and isolated by the algorithm without smoothing requirements). Our goal will be to develop nonlinear inversion algorithms for a wide variety of function sets (splines, exponential functions, power series, etc.) from a unified point of view. Following that, a scaling theory will be developed to accommodate the non-exponential transmittances of the atmosphere.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0024, PROBABILITY MODELS OF JOINT OR SIMULTANEOUS WEATHER

I.A. LUND, U.S. Air Force, Geophysics Laboratory, *L.G. Hanscom A.F.B., L.G. Hanscom A.F.B., Bedford, Massachusetts* 01730 (DF581550)

AF function - planning of operations that require knowledge of risk of joint occurrences of weather that are either simultaneous over wide areas of terrain or are successive events during an Air Force mission. Deficiency - improvement is required not only in the simple knowledge of joint probabilities but in the objectivity and rapidity with which an evaluation can be made of the probabilities that a multi-phased mission, anywhere in the world, will succeed. Objective - to obtain probabilities of joint occurrences of weather events at several alternative bases or targets or over wide areas of terrain. How development contributes - by providing estimates of climatic risks to Air Force operations.

Conditional, joint or simultaneous probabilities will be derived from unconditional single-point or single-instant probabilities through modeling. Because the weather input into mission planning is expected to be automated, the models will be developed for use on high speed computers. Long records of weather observations will be used to develop and test the models.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0025, AURORAL SCINTILLATION MODELLING STUDIES

J.P. MULLEN, U.S. Air Force, Geophysics Laboratory, *L.G. Hanscom A.F.B., L.G. Hanscom A.F.B. , Bedford, Massachusetts* 01730 (DF580910)

AF function - communications/navigation. Deficiency - signal fading, range errors. Objective - to model ionospheric parameters and predict deficiencies. How research contributes - develops and tests predictive models of ionospheric scintillation based on actual data to be used by AWS. Model will include effects of elevation and frequency scaling.

Using actual data from Goose Bay and Narssaq point, models will be constructed using geophysical parameters to predict scintillation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0026, ONE-DIMENSIONAL STRATOSPHERIC MODEL
S.P. ZIMMERMAN, U.S. Air Force, Geophysics Laboratory, *L.G. Hanscom A.F.B., L.G. Hanscom A.F.B., Bedford, Massachusetts* 01730 (DF581180)

AF function - environmental impact on the stratosphere of high altitude vehicle and natural and man-made effluents. Deficiency or opportunity - chemical-transport models for determining species and thermal distributions of the normal and perturbed stratosphere. Objective - theoretically calculate and describe how the normal species distributions of the stratosphere are affected by dynamical perturbations such as thunderstorms and intense mountain wave turbulence. How research contributes - improved time dependent theoretical models to determine effects of operational systems on the environment utilizing realistic transfer coefficients.

The approach is to dynamically model the depletion or increase of the normal atmospheric composition due to the seasonal influences of turbulence, generated by intense mountain waves, jet streams and thunderstorm activity.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0027, ANALYSIS OF LUNAR RANGING DATA FOR EARTH DYNAMICS APPLICATIONS
C.C. COUNSELMAN, Mass. Inst. of Technology, School of Science, Geology & Geophysics, 77 *Massachusetts Ave., Cambridge, Massachusetts* 02139 (NSG 7428)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0028, FIELD STUDIES OF POSSIBLE IMPACT CRATERS IN ONTARIO
W. PINSON, Mass. Inst. of Technology, Graduate School, 77 *Massachusetts Ave., Cambridge, Massachusetts* 02139 (NSG 7467)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0029, ELECTRON HEATING OF THE MID- AND AURORAL LATITUDE IONOSPHERE
M. KANAL, Univ. of Lowell, Graduate School, *Lowell, Massachusetts* 01854 (DF248690; F19628-77-C-0065)

AF function - communication, navigation, ionosphere and magnetosphere modelling. Deficiency - inadequate knowledge of heating mechanisms and their effects on topside scale heights for needs of AF systems. Objective - to calculate the heating rate of mid-latitude ionosphere as a result of bombardment by energetic photoelectrons from the conjugate ionosphere. A similar study of effects of high energy auroral bombardment will also be undertaken. Results will be compared to in-hand data from AF satellite experiments. How research contributes -provides information essential to microwave and radio frequency transmission through auroral and mid-latitude topside ionosphere, provides data essential for design and utilization of communication guidance and surveillance systems, provides understanding of auroral and mid-latitude ionospheric transport mechanism.

Apply existing computer codes to analyze and synthesize af satellite data in auroral and mid-latitude topside ionosphere.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0030, INTERACTIONS OF PRECIPITATING ELECTRONS WITH THE IONOSPHERE USING CHARACTERISTIC SPECTRAL PARAMETERS
E.G. FONTHEIM, Univ. of Michigan, School of Engineering, Atmospheric & Ocean Science, *Ann Arbor, Michigan* 48106 (NSG 5281)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0031, CHEMICAL AND DYNAMICS PROCESSING AT HIGH LATITUDES
A.F. NAGY, Univ. of Michigan, School of Engineering, Atmospheric & Ocean Science, *Ann Arbor, Michigan* 48106 (NSG 5282)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0032, AIR PHOTO ASSESSMENT OF TREE SURVIVAL FOLLOWING FLOODING
C.E. OLSON, Univ. of Michigan, School of Natural Resources, *Ann Arbor, Michigan* 48104 (0067811; MICY00087-F)

OBJECTIVE: Determine the number of living trees in five flooded populations of mixed bottomland species from air photos. Relate survival to water depths and flooding history.

APPROACH: Tree counts made from 1:8000 scale air photos taken six years after initial impoundment of Lake Oklawoka, Fla. Data compared with earlier ground data and field investigation one month after date of photography.

PROGRESS: Work is still delayed by the lack of additional photography resulting from adverse weather over the test site. Work will proceed during the Fall and Winter (1976-77) with data now on hand.

SUPPORTED BY Michigan State Government

5.0033, REMOTE SENSING OF YIELD OF FOREST PLANTATIONS
C.E. OLSON, Univ. of Michigan, School of Natural Resources, Fisheries Forest Wildlife Prog, *Ann Arbor, Michigan* 48104 (0072439; MICY00098-F)

OBJECTIVE: Determine if yield of forest plantations can be determined from remote sensor data; How such remote-sensing data can be economically introduced into management and harvesting decisions.

APPROACH: A review of industrial forest plantation practices will be made in the South (North Carolina, Tennessee, and Texas), Lake States (Michigan), and Pacific Northwest (Washington-Oregon) to determine the critical factors affecting plantation yield. These factors, including initial survival, growth rates, and damage due to insects or disease, will be compared with proven and probable remote sensing capabilities. From this comparison we expect to identify those variables amenable to evaluation through remote sensing techniques. An attempt will be made to develop a regression model that will permit integration of known site data (e.g., soils, precipitation, and temperature) with remote sensor data to predict yield at rotation age, and to refine that prediction as additional data becomes available. We plan to work with the Weyerhaeuser Company and Packaging Corporation of America to identify how best to intergate such yield predictions into operational management processes. Approval of both firms has been obtained.

PROGRESS:

SUPPORTED BY Michigan State Government

5.0034, USE OF REMOTE SENSING FOR LAND USE POLICY FORMULATION
R.D. VLASIN, Michigan State University, Agric. Experiment Station, Resource Development, *New Administration Bldg., East Lansing, Michigan* 48823 (0064769; MICL01168)

OBJECTIVE: To demonstrate the operational ability and uses of remote sensing for land use planning and policy formulation. Specifically to: develop, apply, and evaluate a system which will incorporate remote sensing for classifying land use and resource characteristics; apply remote sensing to program needs of selected Michigan agencies; apply the findings of the research to the land use policy formulation process in Michigan.

APPROACH: Actual sites selected with governmental units to test usefulness of various RS applications. 'Short-term' direct agency applications to permit development, completion, evaluation, and approaches. Applications also to longer-run policy efforts. Departments of Crop & Soil Sciences, Forestry, Resource Development, Urban Planning & Landscape Architecture, and Geography involved.

PROGRESS: During 1976 remote sensing has been used to derive data required for effective land/resource use decisions and actions by a wide range of agencies in Michigan. At the county level a comprehensive inventory of water bodies was prepared to assist fire departments in Antrim Co. with water recharge operations. Inventories of land use, marinas and stock piles along the Detroit Riverfront made a major contribution to the Riverfront Development Task Force coordinated by Wayne Co. Plng. Comm. A demonstration effort for Windsor Twp., Eaton Co. at the request of the Equalization Director has provided a refined land value model which combines remotely sensed land use data and soils data for land value assessment. This is an additional element to the Resource Analysis Program which is a computer-based information system designed to integrate spatial resource data for regional planning. A comprehensive water/wetland inventory for the City of Lansing Vector Control Section from specially acquired color photography has significantly improved information necessary for an effective mosquito eradication program. Analysis of vegetation dynamics in the Grand Mere dune environment has provided the Grand Mere Association with information necessary in plans to control intensive recreation development. Color infrared imagery acquired at several different times in the growing season allowed monitoring of the biomass of an old field ecosystem that was being used as an area for recycling of waste water.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, Michigan

5.0035, OCEAN FORECASTING EXPERIMENT (OFEX)
S.A. PIACSEK, U.S. Navy, Naval Oceanographic Lab., *Bay St. Louis, Mississippi* 39529 (DN894403)

To develop scientifically valid ocean forecast models with operational utility. They will be able to periodically incorporate observational data (including those from satellites), and execute on operational navy computers. Their purpose is to provide regional and global ocean environmental information for acoustic propagation models and air-sea exchange parameters to the atmospheric prediction model.

To solve numerically the equations of hydrodynamics and thermodynamics relevant to the scale of motion or ocean region considered. Particular emphasis will be placed on (a) coupling a limited-area model, accepting local data input to the large scale flow; (b) correct handling of vertical and sea-air exchange processes; (c) utilization of satellite-derived sea surface temperatures and wind stresses.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Ocean Research & Development Activity

5.0036, MANAGEMENT DECISION-MAKING BY MISSISSIPPI'S NONINDUSTRIAL PRIVATE FOREST LANDOWNERS
J.E. MOAK, Mississippi St. University, School of For. Resources, Mcintire Stennis Program, *102 Experiment Station Bldg., Mississippi State, Mississippi* 39762 (0061422; MIS-0612)

OBJECTIVE: Develop a timber-growing classification system on the ground along with an ownership constraint classification system. Develop a parallel classification system on aerial photographs and correlate the two so that timber growing condition classes may be determined from aerial photographs. Using multivariate analysis techniques, test for correlation of owner characteristics with timber-growing condition classification levels. Test and validate the techniques and classification of objectives 1, 2, and three in another county which has different conditions and characteristics.

APPROACH: Using a random sample drawn from one county located within the Tennessee-Tombigbee Waterway a combination of field examination, remote sensed imagery and personal interview ownerships will be classified into timber-growing and ownership constraint conditions.

PROGRESS: In further analysis of nonindustrial forest landowners, data showed that 6 variables were significant in discriminating among management level groups. Management level was higher in proportion to forest acres owned, if the landowner had used foresters, if the landowner intends to invest in management, and if he had sold timber recently. The two other variables, education level and distance from the landowners' residence to his property, were significant but showed no linear relationship. One of the major reasons nonindustrial landowners fail to perform forestry practices is their lack of information on expected financial returns from investing in these practices. Professional landowner assistance in Mississippi is limited due to inadequate relevant data. A set of investment analysis tables is being prepared to satisfy this need. The set will show Internal Rate of Return. Present Net Worth, and Equivalent Annual Income as influenced by various stand structures, site qualities, timber type, costs, prices, interest rates and management regimes. Mississippi has been divided into 6 appropriate regions within which the tables will apply and thus provide a guide for each region. Stand structure, cost and price data have been collected; yield data for loblolly pine plantations is in hand; an appropriate growth projection computer program for mixed stands has been modified to handle the various management regimes; and a computer program has been adapted to handle the investment criteria computations.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, Mississippi

5.0037, EVALUATION OF LINEAMENT ANALYSIS AS AN EXPLORATION TECHNIQUE FOR GEOTHERMAL ENERGY
D.T. TREXLER, Univ. of Nevada System, State Bureau of Mines & Geol., *Reno, Nevada* 89557 (E(26-1)-0671)

The Nevada Bureau of Mines and Geology is conducting a study on the relationship of hot springs (geothermal anomalies) and structural lineaments in northern Nevada. The proposed study will comprise a two-phase approach over a two-year period. The first phase of the proposed study is to use available aircraft and spacecraft photographic data over an area where numerous studies of the potential for geothermal productivity have been made. The ultimate objectives of the proposed investigation would be to evaluate the usefulness of lineament analysis of aircraft and spacecraft photography as a reconnaissance technique for geothermal exploration. The study is part of a larger project sponsored by the Nevada Bureau of Mines and Geology, Nevada Geothermal Resources.

SUPPORTED BY U.S. Dept. of Energy, Div. of Geothermal Energy

5.0038, GLOBAL TECTONIC STUDIES
K. BURKE, State University of New York, School of Arts & Sciences, Geological Sciences, *1400 Washington Ave., Albany, New York* 12222 (NSG 5274)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0039, A MORPHOLOGICAL STUDY OF WAVES IN THE THERMOSPHERE
S.H. GROSS, Polytechnic Inst. of New York, School of Science & Engin., Electrophysics, *333 Jay St., Brooklyn, New York* 11201 (NSG 5284)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0040, RESOURCES INVENTORY AND ANALYSIS FOR ENVIRONMENTAL PLANNING
L.S. HAMILTON, Cornell University, Agric. Experiment Station, Mcintire Stennis Program, *Ithaca, New York* 14850 (0010760; NYC-147552)

OBJECTIVE: Evaluate the usefulness of various kinds of resource information so that environmental planning is more cognizant of the impact of development on the resource components of the landscapes under scrutiny. Classify land resources and related water for planning purposes. Explore methods of retrieval and display of resource information.

APPROACH: Airphotos and other remote sensors will be particularly emphasized as sources of resource information for analysis. Case study areas will be selected where issues of environmental impact arise. Methods of analysis and display will be developed which are useful to the planning process.

PROGRESS: The Catskill land use study sub-project was terminated with the completion of a doctoral dissertation and the initiation of an extension program in the Town of Andes. A technique for combining certain biophysical environmental parameters with socio-economic characteristics and goals into planning units and performance standards for controlling land use, has been developed. Airphotos, soil survey maps, Land Use and Natural Resources Inventory (LUNR) maps, farm viability classification, ownership data and ownership attitudes were the information base melded into planning divisions. This method is applicable in metropolitan hinterlands where vacation homes, agriculture and recreation are the dominant forms of land use, and where farm and forest land is being 'invaded' by recreation homes. The Delaware County Planning Dpeartment has accepted this method as applicable for other towns, and it is being recommended to the Catskill Commission. A sub-project has been initiated in the area of environmental analysis and impact analysis of high voltage transmission lines. This follows from previous work under this project on highway route selection. We are also attempting to integrate biophysical classification methods previously developed with concepts of 'appropriate' agricultural technology for environmentally fragile or sensitive areas (e.g., steep terrain) in economically underdeveloped areas.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, New York

5.0041, THEORETICAL STUDIES OF IONOSPHERIC IRREGULARITIES

R.N. SUDAN, Cornell University, Lab. of Plasma Studies, *Ithaca, New York* 14850 (DN780191; N00173-76-C-0359)

The DOD is becoming increasingly dependent upon satellite systems for communication, surveillance and navigational purposes. It has become increasingly evident over the past few years that turbulent structure developing in the ionosphere can adversely affect the transmission of satellite signals. This affect manifests itself in fluctuations in the phase and amplitude of the transmitted signal. The objective of the current program is to assist in identifying the cause and characterizing the properties of the relevant ionospheric plasma turbulence. This information is needed in order to provide prediction of satellite systems performance.

Modern theories of strong plasma turbulence are employed to characterize turbulence in the ionized component of the e and f regions of the ionosphere. The results of these calculations are compared with numerical studies performed at NRL and with radar data taken in the field.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

5.0042, APPLICATION OF GEOS-3 ALTIMETER DATA TO SOLUTION OF PROBLEMS IN EARTH DYNAMICS

M. TALWANI, Columbia University, School of Arts & Sciences, Geology, *Broadway & W. 116th St., New York, New York* 10027 (NSG 5273)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0043, NON-NUCLEAR POLLUTANTS IN STRATOSPHERIC AIR

E.P. HARDY, U.S. Dept. of Energy, Health & Safety Laboratory, *376 Hudson St., New York, New York* 10014 (001783)

Particulate sampling is conducted by both aircraft and balloons. The balloon program provides samples from 20 to 27 km at 65 degrees N, 33 degrees N, and 9 degrees N, several times a year. The aircraft sampling extends from 75 degrees N to 10 degrees S in the western hemisphere and ranges in altitude from 12 to 19 km. At least three aircraft missions are flown per year. The National Center for Atmospheric Research receives a portion of each filter for analyses of sodium, potassium, calcium, magnesium, chloride, sulfate and nitrate. Total stratospheric air is collected in stainless steel spheres through compressors. The total air samples are analyzed at HASL for freon-11 (CCl/sub 3/F), sulfur hexafluoride (SF/sub 6/) and other halocarbons. Nitrogen oxides, specifically N/sub 2/O will be added to the program. Freon-11 and sulfur hexafluoride are ideal tracers for global atmospheric diffusion studies and the freons are also important for their potential effect on the ozone shield. The other halocarbons and N/sub 2/O now appear to have a considerable bearing on the chemistry of the stratosphere and should help to explain atmospheric behavior of trace gases.

SUPPORTED BY U.S. Dept. of Energy, Health & Safety Lab.

5.0044, PHASE STABILITY AND ELASTIC WAVE VELOCITY DETERMINATIONS FOR STOICHIOMETRIC FES

T. TAKAHASHI, Columbia University, Lamont Doherty Geolog. Observ., *Palisades, New York* 10964 (NSG 7434)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0045, IONOSPHERIC PROPAGATION SIMULATION

G. SALES, U.S. Air Force, Rome Air Development Ctr., *Griffiss Air Force Base, Rome, New York* 13440 (DF902790)

AF function - long-range detection. Deficiency/opportunity - models for simulating HF propagation in the arctic (auroral) environment are not sufficient to adequately predict the performance of Air Force systems or provide information for the design of new techniques to improve operational capabilities. Objective - development of new theoretical and numerical models of ionospheric characteristics which influence radio wave propagation and the design of improved ray-tracing techniques. Development of a better understanding of radio propagation through small scale irregularities in the ionosphere, and improvement of state-of-the-art of radio signal detection in the presence of fading and clutter due to propagation through an inhomogeneous ionosphere. How research contributes - this research is directed at improving the inputs to a realistic model of HF propagation, particularly in the auroral region of the ionosphere. These new models in conjunction with fast and accurate ray tracing will allow assessment of system performance to be made in near real time and with models of auroral HF clutter allow for both prediction of system performance and improved operational capabilities of existing systems.

New and improved ionospheric modelling techniques will be developed primarily on the basis of analysis of existing radio propagation data. Data which in the past could not be used for this purpose (oblique backscatter data) will be incorporated by the use of newly developed ray tracing and computational techniques. Data from experimental OTH radars will be used to develop an auroral clutter model. The new ray-tracing techniques will be developed primarily from theoretical considerations, although full advantage will be taken of improvements in the size and speed of modern digital computers.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

5.0046, FORECASTING RESEARCH TO ACCESS THE ROLE OF DIFFERENTIAL ADVECTION AS A SEVERE STORM PREDICTOR

R.M. ATLAS, State University of New York, Graduate School, *Stony Brook, New York* 11790 (NSG 5271)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0047, RESEARCH OF ALTIMETER DATA IN ORDER TO IMPROVE EXISTING GRAVITY MODELS
E.G. SCHMIDT, Ohio State University, Graduate School, *190 N. Oval Dr., 102 Administration Bldg., Columbus, Ohio* 43210 (NSG 5275)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0048, AN INVESTIGATION OF THE CRATERING-INDUCED MOTIONS OCCURRING DURING THE FORMATION OF BOWL-SHAPED CRATERS
A.J. PIEKUTOWSKI, Univ. of Dayton, Graduate School, *300 College Park Ave., Dayton, Ohio* 45409 (NSG 7444)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0049, DEVELOPMENT OF A CLIMATE MODEL USING A TIME DEPENDENT ENERGY BALANCE FORMULATION
F.B. HOUSE, Drexel University, School of Science, Physics & Astrophysics, *32nd & Chestnut Sts., Philadelphia, Pennsylvania* 19104 (NSG 1545)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0050, LITHOLOGICAL CHARACTERIZATION OF CRYSTALLINE BASEMENT ROCK PROVINCES IN THE UNITED STATES
E.G. LIDIAK, Univ. of Pittsburgh, School of Arts & Sciences, Earth & Planetary Sciences, *4200 5TH Ave., Pittsburgh, Pennsylvania* 15260 (NSG 5270)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0051, SYNTHESIS OF REGIONAL CRUST AND UPPER-MANTLE STRUCTURE FROM SEISMIC AND GRAVITY DATA
S.S. ALEXANDER, Penn. State University, School of Earth & Min. Sci., Geosciences, *116 Deike Bldg., University Park, Pennsylvania* 16802 (NSG 5276)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0052, RAPID MAPPING OF LAND USE BASED ON REMOTE SENSED DATA
F.Y. BORDEN, Penn. State University, School of For. Resources, *102 Ferguson Bldg., University Park, Pennsylvania* 16802 (0059566; PEN01931)

OBJECTIVE: Develop a system of rapid classification and mapping of land use based on aerial photographic and multispectral remote sensed information.

APPROACH: Using computers and other specialized automatic image analysis equipment, aerial photographs, multispectral imagery and digitized imagery data will be analyzed by multivariate statistical methods and by machine-researcher interactive means to produce map displays of land use patterns such as forest types, agricultural and non-agricultural open land as two of many examples.

PROGRESS: Using the system for processing multispectral scanner (MSS) data from LANDSAT, analysis and mapping were done of land cover in Columbia county, Pa., of forest cover in parts of the Allegheny National Forest, and of geology of the San Matral region in Saudi Arabia. Results were most satisfactory using canonical analysis. Image enhancement was obtained by transforming the data by the first three axes of the canonical transformation matrix followed by a color film or cathode ray tube display. Twenty-two Skylab S192 MSS channels were evaluated by principal components and canonical analyses. Three spectral bands were found to be most important in discriminating among targets typical of Pennsylvania. Suitability analyses of various land uses for the Delaware River Water Gap Natural Recreation Area were performed on resource data organized in a grid cell format. For each land use, suitability ratings were assigned to attributes of appropriate data variables. The ratings of these data attributes for a given cell are added to arrive at an overall cell suitability score. Grey scale maps depicting various land use suitabilities were overlaid on the preliminary development plan in order to identify critical areas. Land classification maps based on data attributes or activity suitabilities were also developed to assist in planning.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, Pennsylvania

5.0053, STATISTICAL ANALYSES OF RELATIONS BETWEEN THUNDERSTORMS AND EXTRA-TERRESTRIAL VARIABLES
H.S. PANOFSKY, Penn. State University, School of Earth & Min. Sci., Meteorology, *116 Deike Bldg., University Park, Pennsylvania* 16802 (ATM77-00871)

In a previous project, a statistical analysis was carried out to see whether thunderstorm frequencies are related to solar variations. Some of the results were of marginal statistical significance.

Since that time, ten years have elapsed and additional data have accumulated. These will be used to provide an independent test of the relationships suggested earlier.

Also, in the meantime, some studies have suggested that the crossings of sector boundaries are related to phenomena in the earth's atmosphere. Therefore, thunderstorm statistics will be related to sector crossings, and the significance of the results will be tested.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0054, FEASIBILITY OF REMOTE SENSING BENTHIC MICROALGAE
R.G. ZINGMARK, Univ. of South Carolina, School of Science & Math., Biology, *Administration Bldg., Room 115, Columbia, South Carolina* 29208 (NSG 1523)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0055, CATOOSA LAND TYPE MAP
J.A. ELDER, U.S. Tennessee Valley Auth., Div. of For. Fish. & Wlf. Dev., *Norris, Tennessee* 37828

OBJECTIVE: To develop an inexpensive alternative to detailed soil maps for use in natural resource management where soil information is not available. To test the hypothesis that there are certain natural boundaries on the earth that are meaningful to all resource disciplines.

APPROACH: An interdisciplinary team of foresters, soil scientists, wildlife biologists, and a geologist using geologic and topographic maps, aerial photos, published information, and extensive fieldwork delineated homogenous biological areas on the 80,000-acre Catoosa Wildlife Management Area. The final classification scheme, describing nine land types, represented the consensus of the team.

The land type map will be used with other spatial data in developing a comprehensive management plan for the Catoosa Wildlife Management Area.

SUPPORTED BY U.S. Tennessee Valley Authority

5.0056, ELECTRODYNAMIC COUPLING IN THE IONOSPHERE MAGNETOSPHERE SYSTEM
D.M. KLUMPAR, Univ. of Texas, Graduate School, *Dallas, Texas* 75230 (NSG 5280)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0057, INVESTIGATION OF LOW ALTITUDE PLASMA PHENOMENA
P.H. REIFF, Rice University, Graduate School, *6100 Main St., Houston, Texas* 77001 (NSG 5286)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0058, LABORATORY INVESTIGATION OF ATMOSPHERIC COLLISION PROCESSES
R.F. STEBBINGS, Rice University, Graduate School, Space Physics & Astronomy, *6100 Main St., Houston, Texas* 77001 (ATM77-23808)

This grant funds an experimental program seeking to provide laboratory data on a number of aeronomically important atomic and molecular collision processes. The processes of interest have not been adequately studied in the past and further laboratory data is required for a full interpretation of the structure, composition and behavior of the atmospheres of Earth and other planets. The experiments funded focus attention upon two areas in which past studies of low energy ion-neutral collisions have been deficient for atmospheric applications. A major emphasis of the proposed experiments is on collisions in the energy range from thermal to 10 eV, which is of great aeronomic interest but which has been largely neglected because of the experimental difficulties which are inherent to such studies. The proposed research also places special stress upon the role of excited states in these low-energy collisions. The presence of long-lived excited states in the atmosphere has been recognized for many years. Only recently, however, has the full importance of these states to atmospheric chemistry and to laboratory aeronomy been realized. It is now apparent that in many circumstances excited species play a dominant role both in the atmosphere and in the laboratory.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0059, INSTALLATION OF A SOLAR ENERGY SYSTEM
UNKNOWN, Univ. of Houston, Graduate School, *3801 Cullen Blvd., Houston, Texas* 77004 (DEN 8 1)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0060, THEORETICAL STUDIES OF MAGNETOSPHERIC PHENOMENA
WJ. HEIKKILA, Univ. of Texas, Center for Space Sciences, *Richardson, Texas* 75082 (ATM78-03603)

This grant continues the work done on NSF grant ATM76-14916 during the next two years. It involves study of the latest observations of auroral phenomena, and on their theoretical interpretation.

In the past year the research effort has extended criticism of current magnetospheric theories, especially of magnetic reconnection, with four publications. At the same time a more positive approach was made based on induced fields, advancing a mechanism for producing very energetic particles. The model used is ready, and several papers on auroral observations are about ready for submission to a journal.

This grant will continue the work on both observations and the theory. The ultimate aim is to integrate both into a firm understanding of the origin of the aurora caused by magnetospheric dynamics.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0061, THE EFFECT OF EXTENDED MOUNTAIN RANGES ON THE ATMOSPHERIC FLOW
J. PAEGLE, Utah Higher Education System, School of Mines & Mineral Ind., Meteorology, *1400 E. 2ND S.; Salt Lake City, Utah* 84112 (INT77-21706)

This award to the University of Utah makes it possible for Drs. Julia and Jan Paegle to study 'the Effect of Extended Mountain Ranges on the Atmospheric Flow'. The Paegles will work in cooperation with J.V. Zubillaga, C.E. Ereno and N.O Garcia of the Argentine Naval Hydrographical Service in Buenos Aires, Argentina.

The scientists will study and compare atmospheric flows over the Rocky Mountains and the Andes. Their work should contribute toward an understanding of the process of cyclogenesis or cyclone intensification that takes place on the lee side of these mountain ranges. The Argentinian colleagues will gather and prepare the data over the Andes mountains in the border between Argentina and Chile. Ocean data will be obtained from satellite measurements. The theoretical and numerical analyses will be done largely by the U.S. scientists.

SUPPORTED BY U.S. National Science Foundation, Div. of International Programs

5.0062, DEVELOPMENT OF A REMOTE SENSING APPLICATIONS PROGRAM IN VERMONT
H.H. JOHN, Univ. of Vermont St. Agr. Col., School of Natural Resources, *85 S. Prospect St., Burlington, Vermont* 05401 (NSG 7453)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0063, SOFTWARE SYSTEMS FOR PROCESSING ADVANCED SATELLITE DATA
L.P. MURPHY, U.S. Army, Engineer Topographic Labs., *Fort Belvoir, Virginia* 22060 (31580)

OBJECTIVES: Analyze, model, develop techniques/software; and perform feasibility testing of algorithms for extracting useful terrain data from advanced (LANDSAT-D) satellite systems for selected CoE applications; obtain hardware/software trade-offs and costs for computer processing of the advanced high resolution (30 m/pixel) Thematic, Mapper, LANDSAT-D, digital data.

APPROACH: Through in-house efforts, conduct a search and review of NASA studies which assess the impact of processing LANDSAT-D, Thermatic Mapper (TM) data (approximately 8 times LANDSAT A and B) using current ADP systems and techniques, locate and/or acquire digital simulations of the TM data and/or acquire RBV (40 m) digital imagery from LANDSAT (launch date February 1978). Generate or modify software and process simulation. TM data into image forms using ETL DIAL and EBR; evaluate utility of images and pixel data for selected CoE applications (e.g., permits, open water detection). Under contract in the latter part of FY78 perform limited experimentation, comparative analysis of land-use extraction outputs from NASA partially processed data and from corrected MSS data (resample) and provide recommendations for improved software/algorithms and techniques. As work is phased through FY 78-80, digital image processing costs, software/algorithms, associated hardware and/or commercial sources to the CoE Districts and Divisions will be identified for feature extraction processing from advanced (LANDSAT-D) satellite data. The results of other ETL feature extraction research from military and ASPO funding will be incorporated into the results of this work unit.

SUPPORTED BY U.S. Dept. of Defense, Office Chief of Engineers, Corps of Engineers

5.0064, RIES CRATER STUDIES
E.C. CHAO, U.S. Dept. of The Interior, Geological Survey, Geologic Division, *12201 Sunrise Valley Dr., Herndon, Virginia* 22092 (9580-01457)

The project, which will terminate in the currrent year, has focused on developing an understanding of the creation of the Ries Basin of southern Germany. As the largest well-preserved impact crater on Earth and the best terrestrial analog for lunar and planetary shallow multiring basins the Ries, once understood, can furnish clues to resolving problems of provenance of lunar

highland breccias, and characteristics of lunar crater ejecta and the mechanisms of their transport. On the basis of the constraints imposed by geologic, geophysical and petrologic data a model has been proposed which postulates that the shallow Ries Crater was produced by the impact of a stony meteorite, about 3km in diameter, at a velocity of about 15 km-sec. Lateral, radially outward forces become dominant in this shallow excavation as the impacting body fragmented and flowed rapidly outward. Most of the target materials (more than 90%) were displaced laterally in a rolling, gliding, cascading, nonballistic motion with much mixing of the ejecta with local underlying materials during transport. The principal exposures at the Ries, which are critical to the understanding of the evolution and development of the multiring structure, are presently being documented and will be published along with photographs and interpretations as a new guide to the Ries.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0065, METALLOGENIC STUDIES

P.W. GUILD, U.S. Dept. of The Interior, Geological Survey, Geologic Division, *12201 Sunrise Valley Dr., Herndon, Virginia* 22092 (9340-00244)

Continue assembling mineral deposit data for North America; plot data on map at 1:5,000,000, together with geologic/tectonic information, for visual analysis of their metallogenic significance, delineation of provinces and epochs, and their possible relationship to other events in earth history (particularly global tectonics). Enter data into computer storage for machine analysis in the future. Stimulate, maintain contacts with similar efforts on other continents.

Simplify, plot the data at 1:10,000,000 for the Circum-Pacific Minerals Map of NE Quadrant; advise on assembly and plotting of minerals data for the remaining quadrants (including Antarctica); codify the data for computer storage, retrieval, and analysis.

Maintain contact with IGCP Project 'Remote Sensing and Mineral Exploration,' based on LANDSAT imagery and mineral deposit data; a principal objective is to evaluate the role of lineaments and circular structures in localizing mineral deposits.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0066, LUNAR HIGHLANDS BRECCIAS

O.B. JAMES, U.S. Dept. of The Interior, Geological Survey, Geologic Division, *12201 Sunrise Valley Dr., Herndon, Virginia* 22092 (9710-01365)

Work will concentrate on studies of petrology of lunar highlands breccias 73215 and 73255, and on leadership of interdisciplinary consortium research on these samples. These breccias appear to represent consolidated ejecta from the Serenitatis basin-forming event. Overall aim of the research is to understand the processes that operated in large lunar impacts and to determine the characteristics of the preimpact lunar crust. Studies will concentrate on clasts extracted from breccia 73215 and on matrix of breccia 73255. The petrologic research will involve detailed petrography, microprobe analysis, and transmission and scanning electron microscopy studies. Consortium leadership will involve planning and coordination of research in all fields, planning of sample distribution, and coordination of oral and published presentation of results. Also planned is a collaborative study (with O.A. Schaeffer, S.U.N.Y., Stony Brook) using the laser-probe 40Ar-39Ar age dating method to define ages of petrographically determined fractions of these breccias.

In addition, participation in two collaborative studies of other lunar breccias is planned. One is a restudy of the petrology of breccia 12013, with J.E. Quick and A.L. Albee, California Institute of Technology. The other is a laser-probe age dating study of a suite of eight Apollo 17 massif breccias, with O.A. Schaeffer.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0067, AEROSOL AND TRACE GAS TRANSFORMATIONS

A.J. ALKEZWEENY, U.S. Dept. of Energy, Battelle Pacific N.W. Lab., *P.O. Box 999, Richland, Washington* 99352 (0553)

The approach consists of field experiments supported by diagnostic modeling and data interpretation. The measurement will be made in a Lagrangian frame of reference using instrumented aircraft. A definite buildup of ozone was measured downwind of the city. Furthermore, in most cases, increases in the concentration of sulfate and nitrate aerosol with distance from the source was detected. These increases were also reflected in the independently measured aerosol size distributions. There was evidence from the trace metals data to indicate that meteorological conditions over Lake Michigan were sufficiently stable to render diffusion and particulate deposition essentially negligible. (1) Analysis and interpretation of data collected during last field operation, 1 October 1976. (2) Organize significant findings for reporting and publication, 1 December 1976. (3) Preparation for yield operation, 1 February 1977. (4) Conduct a Lagrangian experiment over Lake Michigan, 1 June 1977. (5) Data analysis, 15 July 1977.

SUPPORTED BY U.S. Dept. of Energy, Div. of Biomedical & Environmental Research

5.0068, STUDIES OF THE PLANETARY BOUNDARY LAYER

J.A. BUSINGER, Univ. of Washington, School of Arts & Sciences, Atmospheric Science, *C301 Health Sciences Bldg., Seattle, Washington* 98105 (ATM77-23715)

The objective of this research is the experimental investigation of the effects of the surface terrain on boundary layer processes in the vicinity of the Boulder Atmospheric Observatory (BAO). In short, an examination of inhomogeneous flows produced by the presence of roughness elements of various sizes. This entails a classification of element sizes and their distribution along with considerable detail of the actual airflow in the vicinity of typical elements. If the detailed description of the flow seems neither feasible nor desirable, a description of the integrated effects will be sought.

These observations should provide the ingredients for a new conceptual and mathematical basis for interpreting characteristics of the boundary layer over inhomogeneous terrain.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0069, FIELD-ALIGNED PARTICLE FLUXES AND PARALLEL ELECTRIC POTENTIAL

C.S. LIN, Univ. of Washington, School of Arts & Sciences, Geophysics, *C301 Health Sciences Bldg., Seattle, Washington* 98105 (NSG 5283)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0070, REMOTE SENSING STUDIES APPLIED TO INTERPRET FRACTURE SYSTEMS AND STRUCTURAL STYLES IN THE PLATEAU REGIONS (ABBREV)

R.C. SHUMAKER, West Va. University, School of Arts & Sciences, Geology & Geography, *Morgantown, West Virginia* 26506 (EY-76-S-21-8040)

This remote sensing study consists of four tasks to: (1) Establish regional fracture patterns for the central and southern Appalachians and the Continental Interior by the use of satellite and aircraft images. Attempt to establish boundary zones between the three geological provinces. (2) Develop a computer program to process data required from lineament maps and field observations. Evaluate statistical and graphical procedures for validity and usefulness to the project. (3) Collect geological information available from publications and private and governmental files in order to determine the relationship of photo lineaments to geology. (4) Using hydrocarbon production data available for the project area, attempt to establish if recoveries are influenced by natural fracture and lineament patterns. Propose well locations to

evaluate the effect of lineament and fractures on hydrocarbon production if arrangements can be worked out with local production companies to support drilling of the well. (FE-TIMS)

SUPPORTED BY U.S. Dept. of Energy, Div. of Coal Conversion & Utilization

5.0071, PRELIMINARY AEROSOL MEASUREMENT (PAM II) DATA REDUCTION
T.J. PEPIN, Univ. of Wyoming, School of Arts & Sciences, Physics, *P.O. Box 3435, University Station, Laramie, Wyoming* 82071 (NSG 1518)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, ASPT SOFTWARE MODIFICATIONS
M.L. CYRUS, U.S. Air Force, Human Resources Laboratory, *Williams A.F.B., Chandler, Arizona* 85224 (DF223670)

To increase simulator fidelity and improve the motion and visual systems so that high performance aircraft such as the F-16 can be simulated. These improvements will provide a functionally separated 30 hz aircraft simulation capability on both cockpit a and cockpit b with sufficient computer core and time to include and integrate motion, visual, g-seat, g-suit, and performance measurement subsystems. Each simulation will be independently controllable and observable. A software concordance capability for documenting the resulting simulation software will be developed. Each cockpit will be programmed to fly in separate mathematical modeling environments, allowing the simultaneous simulation of distinct aircraft and aircraft environments. Additionally, the general data input/output control will be taken from its current sequential processing mode to a parallel processing mode.

The approach is primarily an in-house/contractor software development effort using equipment purchased under other contract efforts. The software development effort is in three primary areas: a. aircraft simulation modules. These include the aeronautical equation changes, de-indexing, and motion and g-seat program modifications required for 30 hz operation and functional separation between cockpits. b. Software handlers. These include the input/output special purpose routines. These routines control the timing, coordination, flow, and control of information between the three mini-computers. C. Software structure and executive. This refers to the modifications required to restructure the simulation and peripheral controller jumplists, develop two new mini-executives for the two slave control processors, and the redesign of datapool.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0002, ASPT AERIAL REFUELING SIMULATION SOFTWARE DEVELOPMENT
E.G. MONROE, U.S. Air Force, Human Resources Laboratory, *Williams A.F.B., Chandler, Arizona* 85224 (DF223800)

To generate a means to assess the training value of different configurations of a CIG system simulating the aerial refueling mission from the receiver aircraft. This is to include various fields of view and levels of image detail of the tanker model.

A technique for varying the visual field of view will be developed. Then a number of KC-135 tanker models will be generated in various levels of image detail. Software for measuring aerial refueling mission performance will also be developed. Finally, a graphics display for monitoring pilot performance will be generated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0003, IN-FLIGHT BIO-MEDICAL ASSESSMENT OF NAVAL AIRCREW MEMBERS
D.H. REID, U.S. Navy, Crew Systems Branch, *Port Hueneme, California* 93042 (DN777291)

To acquire multi-parameter physiological and engineering data from aircrewmen flying high performance naval aircraft via state-of-the-art bio-instrumentation techniques under a variety of normal in-flight conditions including air combat maneuvering (ACM) and missile launch engagement; to conduct metabolic workload studies of aircrew personnel evaluating new tactical procedures, weapons systems hardware or life support equipment; to acquire a data base of physiological responses to operationally realistic in-flight environments such as ACM and missile launchings; to employ meaningful parameters for the specific flight environment; to acquire baseline data from aircrew subjects; to develop potential criteria for assessing aircrew fitness and/or selection, and to perform physiological assessment of combined flight stress of naval aircrewmen under operationally realistic conditions.

To utilize recently developed bio-instrumentation systems for acquiring pertinent bio-medical and engineering parameters continuously throughout selected high performance aircraft flight profiles. The data acquisition systems utilized will have four-hour recording capability on cassette tape recorder and will obtain seven channels of pertinent data including ECG, O2 concentration, inhaled, O2 concentration, exhaled air, O2 consumption, respiratory min. volume, plus or minus gz, voice for event annotation, IRIG 'b' time code. Capabilities of Pacific Missile Test Center Sea-Test Range will be exploited in acquiring operationally realistic data from combat experienced aviators. Self-control study. Baseline data will be collected under laboratory conditions.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Medical Research & Development Command

6.0004, MECHANISMS OF HORMONE-TISSUE INTERACTIONS IN ALTERED GRAVITY STATES
I. GOLDFINE, Univ. of California, School of Medicine, Medicine, *551 Parnassus Ave., San Francisco, California* 94122 (NCA 2-665808)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0005, HARMONIC ANALYSIS OF VESTIBULAR-VISUAL SENSORY CONFLICT
A.L. OCHS, Univ. of California, Graduate School, *551 Parnassus Ave., San Francisco, California* 94122 (NCA 2-665809)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0006, CENTRAL SYNAPTIC ACTIONS OF ANTIMOTION SICKNESS AGENTS
R. FOX, Calif. State Univ. & Colleges, School of Social Science, Psychology, *Washington Sq., San Jose, California* 95114 (NCA 2-675808)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0007, BACTERIAL DENITRIFICATION AND STEADY STATE GROWTH - A PUTATIVE MODEL FOR THE STUDY OF MIXED CULTURES
G.A. TOMLINSON, Univ. of Santa Clara, School of Science, Biology, *El Camino Rd., Santa Clara, California* 95053 (NCA 2-685808)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0008, FACTORS AFFECTING ASSIMILATORY NITRATE REDUCTION BY PROKARYOTES
E.R. LEADBETTER, Univ. of Connecticut, Graduate School, *Storrs, Connecticut* 06268 (NSG 7450)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0009, AUTOMATED ADAPTIVE TRAINING FOR THE LANDING SIGNAL OFFICER
D.A. NORMAN, U.S. Navy, Human Factors Laboratory, *Orlando, Florida* 32813 (DN794013)

To develop, implement and test, in the context of an automated trainer, techniques for training which will improve the training progress of the landing signal officer (LSO) and thereby reduce cost in manpower and equipment, through development of models of the LSO task and pilot-LSO interaction. Use of modeling techniques can increase training effectiveness by providing objective performance measurement and guidance in skill acquisition at any point in the training process.

The effort consists of: (1) identification of visual and auditory cues; (2) development of models of the visual scene, pilot response, and pilot-LSO interaction; (3) application of voice recognition, performance measurement, and automated adaptive training technologies; and (4) empirical test of effectiveness of the training system.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Training Equipment Center

6.0010, TECHNOLOGY INTEGRATION ANALYSES FOR CLOSED LIFE SUPPORT SYSTEMS APPLICABLE TO SPACE HABITATS
J.L. CARDEN, Georgia Inst. of Technology, Graduate School, *225 North Ave. N.W., Atlanta, Georgia* 30332 (NSG 2323)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0011, MECHANISMS OF SPINAL FAILURE
T. BELYTSCHKO, Northwestern University, Graduate School, *633 Clark St., Evanston, Illinois* 60201 (DF323250; F33615-77-C-0526)

This effort will provide an injury prediction capability for the head-spine computer-based model previously developed under AMRL/BBM sponsorship. This capability is necessary to provide design criteria and evaluation techniques for aircraft emergency escape systems and operational procedures. The effort involves the generation of injury criteria from structural analysis of the elements of the spine, and the incorporation of these injury criteria into the total head-spine model. The final product will have applicability to Air Force problems related to emergency escape from aircraft, aircraft crashes and gross impacts to the head and/or torso.

Structural analyses of vertebral elements will be performed using finite element, or equivalent, methodology and failure-level criteria based on these analyses will be established. The modes of failure to be considered will be those observed from military flight operations, and additional ones which may be anticipated from the operational characteristics of future manned military flight systems. The structural analysis will be performed on the elements of both human and chimpanzee spines. The developed local criteria for failure will be incorporated into the total head-spine model in such a manner as to provide probabilities of failure at every local site considered for a total body impact exposure.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0012, DYNAMICALLY IMPOSED OSCILLATING FORCES FOR PREVENTING CARDIOVASCULAR DECONDITIONING
C.E. KNAPP, Univ. of Kentucky, School of Engineering, Mech Engin, *Limestone & Euclid, Lexington, Kentucky* 40506 (NSG 2318)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0013, RENAL FUNCTION, WATER AND ELECTROLYTE BALANCE AND INTESTINAL TRANSPORT IN HYPOKINETIC ANIMALS
X.J. MUSACCHIA, Univ. of Louisville, Graduate School, *2301 S. 3RD, Louisville, Kentucky* 40208 (NSG 2325)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0014, EVALUATION OF ION TEXTURED AL203 SURFACES FOR PERMANENT PROSTHETIC ATTACHMENT
A.M. WEINSTEIN, Tulane University of Louisiana, School of Engineering, Mech Engin, *New Orleans, Louisiana* 70118 (NSG 3209)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0015, HORMONAL CONTROL OF BLOOD VOLUME
D.S. GANN, Johns Hopkins University, School of Medicine, Surgery, *725 N. Wolfe St., Baltimore, Maryland* 21205 (NSG 2324)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0016, DISSECTION OF SENSORY CONTRIBUTIONS TO MOTION SICKNESS PRODUCTIONS
A. HEIN, Mass. Inst. of Technology, School of Hum. & Soc. Sci., Psychology, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NCA 2-425802)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0017, BIO-CHIRALITY SEARCH WITH VARIABLE HELICITY POSITRONS
A. RICH, Univ. of Michigan, School of Lit. Sci. & The Arts, Physics, *Ann Arbor, Michigan* 48104 (NSG 7452)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0018, VISUAL DISPLAYS - APPLICATIONS OF VISUAL SCIENCE TO SYSTEM DESIGN
J.W. WULFECK, New Mexico State University, School of Arts & Sciences, Psychology, *University Park, Las Cruces, New Mexico* 88001 (DN675597; N00014-76-C-0805)

Visual science enjoys the longest history and the most substantial data base of any area on which engineering psychology draws. Despite the overwhelming literature in basic and applied visual research, little of it deals with the way in which visual science data may be applied in man-machine system design and development. This effort organizes and presents the essential content and methods of visual science in the context of typical system development problems, thereby demonstrating how these data can be more effectively utilized.

Several illustrative system design problems are selected as case studies: a Navy CIC, aircraft cockpit instrumentation, and an air strike planning system. The system development process is described in the form of dialogues which explicate the various trade-offs between engineering considerations, human performance capabilities and cost. Relevant visual science data are presented as appropriate, and procedures are described for using the data to help resolve design questions.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

6.0019, BIONIC FEEDBACK CONTROL OF VISUAL DISPLAY DIMMING

D. ROGERS, Univ. of Dayton, Graduate School, *300 College Park Ave., Dayton, Ohio* 45409 (DF228480; F33615-77-C-0080)

To design and develop a bionic controlled feedback system for controlling the acceleration induced dimming of a simulator pilot's visual environment including the visual display and instruments. Such training devices as the simulator for air-to-air combat (SAAC) have visual display dimming capabilities to simulate the vision loss of a pilot under high positive acceleration. However, this sytem is not pilot interactive, the pilot has no physiological (m-1 maneuver) control over the display. State-of-the-art simulators provide no means for a tactical aircraft simulator pilot to control visual display dimming as a function of g. This effort will result in a technique by which pilot straining (m-1) can be sensed and the signal used to control the g effect dimming of simulator visual displays.

The approach is to develop the software and hardware (electrodes and package) to include the pilot in the visual display/simulation control loop. Two algorithms will be developed. One will predict the human visual systems's response to both antecedent and current g-levels. the other will predict the pilot's increased g-tolerance as a function of his ability (which will be determined by monitoring electrymyographic potentials from selected muscle groups) to perform the m-1 maneuver. Development of this algorithm will require experimentation with trained subjects to determine which muscle groups are the most reliable indicators of the effectiveness of the m-1 maneuver. The two algorithms will be integrated to drive a brightness controller for the pilot's visual field. The integrated system will be implemented on the T-38 simulator at the AFHRL STARS Facility. If successful, the system may be refined and integrated with the simulator for air-to-air combat (SAAC). Model development complete - 8 MAC, electrode development complete - 9 MAC, integrated controller operational - 10 MAC, system delivered, integrated on STARS - 11 MAC, final report - 12 MAC.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0020, A COMPUTER-BASED MEASURE OF VOCAL STRESS

M. BRENNER, Oregon State Higher Educ. Sys., Graduate School, *Johnson Hall, Eugene, Oregon* 97403 (NCA 2-587801)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0021, PREPARATION, CHARACTERIZATION, PHYSICAL TESTING AND PERFORMANCE OF FLUOROCARBON MEMBRANES AND SEPARATORS

R.J. LAGOW, Univ. of Texas, School of Natural Sciences, Chemistry, *200 W. 21st St., Austin, Texas* 78712 (NSG 3190)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0022, APPLIED PREDICTIVE MODEL FOR HUMAN EXPOSURE TO THERMAL STRESS IN USAF OPERATIONS

E.H. WISSLER, Univ. of Texas, School of Engineering, Chemical Engin, *200 W. 21st, Austin, Texas* 78712 (DF320430; F33615-77-C-0602)

This effort is designed to develop a computer model for predicting human response to the thermal stresses encountered in USAF operations. Use of such a model should permit prompt answers to questions from the field without the need for human experimentation, and should also serve to pinpoint critical areas where further investigation is indeed required. Although a number of programs on thermoregulation are already in existence, none is immediately suitable for USAF application. This effort will produce either a new model or a modification of an older one for this purpose.

The contractor will develop a digital computer program for predicting human response to thermal stress. The objectives of this contract are: (1) to conduct a review of existing models to determine their suitability for this application, (2) to write a new program or modify an existing one to meet the technical requirements, (3) to provide computer programs written in FORTRAN, compatible with USAFSAM computer hardware, and (4) to compose a technical report summarizing the literature review and citing the experimental findings which form the basis for the model.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0023, ANALYSIS REQUIREMENTS FOR ANTHROPOMETRIC SURVEYS

H.F. MARTZ, Texas Tech University, School of Engineering, Industrial Engin, *P.O. Box 4340, Lubbock, Texas* 79409 (DN799092; N63126-77-M-0154)

The objective of this effort is to develop methods for reducing the cost of anthropometric surveys. Specific goals of the effort are: (1) to determine factor analytic techniques for reducing the number of variables required for characterizing anthropometric populations; (2) to determine techniques for efficiently estimating percentiles of anthropometric populations.

Various procedures for reducing the numbers of variables will be investigated including: (1) principal components and (2) stepwise factor analysis. Four sets of empirical data will be used in this part of the study: (1) USN aviator data - 1964; (2) USAF flight personnel - 1970; (3) USA aviators - 1970; and (4) Monte Carlo data.

SUPPORTED BY U.S. Dept. of Defense, Navy, Pacific Missile Test Center

6.0024, CREW UTILIZATION RULES FOR MAXIMUM TACTICAL OPERATIONS

D.L. MAKALOUS, U.S. Air Force, School of Aerospace Med., *Brooks A.F.B., San Antonio, Texas* 78235 (DF322180)

The objectives are (a) to evaluate fatigue in tactical aircrews and maintenance personnel during schedules of maximum operations (surges and deployments), (b) to determine the time course of recovery following maximum operations, and (c) to adapt and improve the SAM stress battery so as to be sensitive to relatively short duration flights of tactical sorties where 3-4 missions may be flown per day.

N initial field study of a two week sortie surge was conducted on an A-7 squadron in Jul-Aug 76. Documentation was under 7930-09-11 and 7930-09-03, and will continue under this effort. Measurement of cumulative fatigue and physiological cost was performed on TAC personnel conducting a two week sortie surge following simulated deployment. Data analysis is just beginning. Emphasis will be given to the relationship between number of sorties per day, number of consecutive days, and requirements for recovery from fatigue. At this time, there is relatively little data on maintenance personnel that will be of value in many AF operations. Portions of this effort were previously documented under 7930-09-11 and 7930-10-03.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0025, RADIATION PRODUCED BRAIN INJURY - AIRCREW PERFORMANCE DECREMENT

J.L. MATTSSON, U.S. Air Force, School of Aerospace Med., *Brooks A.F.B., San Antonio, Texas* 78235 (DF312190)

Performance decrement has been consistently observed in trained primates exposed to weapons radiation. Since performance is dependent on the central nervous system (cns) a temporary loss of consciousness and/or alteration of brain function can result in mission failure. This effort will investigate radiation injury to the brain and to systems supporting the brain.

Although the mechanisms involved in radiation induced performance decrements are unknown, strong presumptive evidence exists that diminished cardiovascular capacity, leading to diminished blood flow to the brain, is a major factor. Previous radiation-cardiovascular studies have been in an ambient 1 g environment. Since many flight maneuvers subject aircrews to more than 1 g, and g stress is known to adversely affect the cardiovascu-

lar system, there is a need to study the combined effects of radiation plus g stress on the central nervous system and task performance. Pilot experiments will be done on rats, evaluating the effects of radiation plus g versus g alone. Parameters studied will be electroencephalogram, electrocardiogram, and heart rate. If rat studies demonstrate a significant radiation plus g effect, the next series of experiments will be conducted on rhesus monkeys. Parameters studies will be electroencephalogram, electrocardiogram, heart rate, and visual evoked responses.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0026, ADVANCED SIMULATOR DEVELOPMENT
R.P. PATRICK, U.S. Air Force, School of Aerospace Med., *Brooks A.F.B., San Antonio, Texas* 78235 (DF324080)

The objective of this work unit is the development of the capability to conduct advanced experimental research to investigate the effect of nuclear radiation and other stressors, independently and in combination, upon the performance of crew members of Air Force systems. This capability includes more realistic simulation of the crew members task complexity and workload, compatible data collection and preprocessing capabilities, and advanced data analysis procedures to maximize the usefulness of the data.

Advanced simulators more realistically portraying the tasks of crew members of modern manned systems such as strategic bombers, tactical fighters and ground based systems will be developed. Since these more realistic simulators mandate increased qualitative and quantative data output, advanced data collection/preprocessing will be developed concurrently. The increased data flow also requires updated data management and data analysis procedures for timely dissemination of the results.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0027, CAREER PROGRESSION AND PERFORMANCE OF ENLISTED AIR FORCE PERSONNEL
J.M. WILBOURN, U.S. Air Force, Human Resources Laboratory, *Brooks A.F.B., San Antonio, Texas* 78235 (DF233030)

To investigate career progression and performance of enlisted personnel during the time period of 1 Jan 70 through 31 Dec 75 at yearly time intervals. Comparisons will be made during the time period to assess similarities between male and female enlistees in an attempt to achieve maximum utilization of female talent and potential and to determine pre-enlistment identifiers of desirable career personnel.

Biographic, attitudinal, and performance data will be compiled from airman record files on yearly input of male and female enlistees (1970-1975). Criterion data of special interest will include disciplinary actions, APRS, unsuitability discharges, medical data (if available) and reenlistment. Particular attention will be directed to areas where male and female performance is disparate and to factors which may be related to early separation prior to completion of initial tour of duty. Where sample size is sufficient for meaningful interpretation, analyses will be accomplished by AFSC. Distributional, correlational and regression analyses will be accomplished. Milestones - generation of data base, Nov 76-Feb 77, 4 mos, computer analyses, Mar 77-Aug 77, 6 mos, interpretation of data, Sep 77-Dec 77, 4 mos, preparation of final product, Jan 78-Apr 78, 4 mos.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, SYMBOLIC SOLUTION OF LINEAR DIFFERENTIAL EQUATIONS
R.B. FEINBERG, Iowa State Univ. of Sc. & Tech, Graduate School, *Beardshear Hall, Ames, Iowa* 50010 (NSG 1538)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

7.0002, STUDY OF STOCHASTIC PROCESSES OCCURRING IN THE RELIABILITY ANALYSIS OF FAULT-TOLERANT AVIONICS COMPUTING SYSTEMS
D.R. MILLER, Univ. of Missouri, School of Arts & Sciences, Statistics, *130 Jesse Hall, Columbia, Missouri* 65201 (NSG 1540)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

7.0003, NUMERICAL METHODS FOR PROBLEMS INVOLVING THE DRAZIN INVERSE
C.D. MEYER, Univ. of North Carolina, School of Math. & Phys. Scis., Mathematics, *Raleigh, North Carolina* 27607 (NSG 1532)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

7.0004, CONSTRAINED INTERPOLATION AND APPROXIMATION WITH APPLICATION TO COMPUTER AIDED GEOMETRIC DESIGN
J.A. ROULIER, Univ. of North Carolina, School of Math. & Phys. Scis., Mathematics, *Raleigh, North Carolina* 27607 (NSG 1549)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

7.0005, ALGEBRAIC MANIPULATION ON A COMPUTER
R.A. BROUCKE, Univ. of Texas, School of Engineering, Aerospace Engin & Engin Mech, *200 W. 21st, Austin, Texas* 78712

DESCRIPTION: A package of computer programs has been completed for algebraic manipulation of orbital mechanics problems. The programs are now being used for research in artificial satellite theory and in rigid body-motion. The principal goal is to use the computer to generate analytical rather than numerical solutions.

SUPPORTED BY University of Texas

7.0006, NUMERICAL SOFTWARE DEVELOPMENT
A.K. CLINE, Univ. of Texas, School of Natural Sciences, Computer Sci, *200 W. 21st St., Austin, Texas* 78712 (NSG 1544)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

7.0007, AN AUGMENTED LOGRANGIAN PENALTY FUNCTION ALGORITHM FOR NONLINEAR PROGRAMMING
L.C. FRAIR, Virginia Poly. Inst. & St. U., School of Engineering, Operations Research & Ind Eng, *Burruss Hall, Blacksburg, Virginia* 24061 (NSG 1525)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, COMPUTER SIMULATION OF PLASMAS
J.M. DAWSON, Univ. of California, School of Letters & Science, Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (PHY76-83686 A01)

Research on the computer simulation of plasmas will continue. Four main topics will be pursued: 1) the generation of radiation by intense electron beams ('free electron laser') 2) the collective acceleration of particles by intense electromagnetic waves propagating in a plasma 3) plasma and heat transport across magnetic fields 4) the application of computers to plamsa diagnostics, particularly microwave holography. This research is a continuation of that initiated under NSF Grant PHY76-83686.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0002, RESEARCH ON LATTICE MISMATCHED SEMICONDUCTOR LAYERS
R.L. BELL, Varian Associates Incorporated, *611 Hansen Way, Palo Alto, California* 94304

The scope of work under the contract involves growth and evaluation of alloy films on GaAs. Of immediate interest are InGaAsP layers on GaAs and studies of defects and lattice mismatch. Conduct fundamental materials research aimed at developing improved understanding of growth and properties of III-V layered materials for solar energy applications.

SUPPORTED BY U.S. Dept. of Energy, San Francisco Operations Office

8.0003, HIGH INTENSITY LASER ABSORPTION
S. GELTMAN, U.S. Dept. of Commerce, Natl. Bureau of Standards, *325 S. Broadway, Boulder, Colorado* 80302 (2741233)

OBJECTIVE: 1. To measure and calculate absorption properties of atoms and molecules in the presence of intense optical fields, such as those encountered in lasers and in applications such as isotope separation and controlled thermonuclear plasmas. 2. Theoretical evaluation of laser-induced inelastic collision processes, ionization, and charge-transfer. 3. Measurement of multi-photon (high field) ionization processes in group I atoms.

APPROACH: 1. Exact solution of Schrodinger equation for DC field, weak and strong field perturbation methods for free-free absorption. 2. Use of semiclassical perturbation methods and multipole expansion on interaction between atoms. 3. Use synchronized, pulsed tunable lasers to photoionize atomic vapor via resonant and non-resonant sequential photon absorption.

ACCOMPLISHMENTS: Observed anomalous detuning asymmetries in sodium. Measured new multiphoton production process for Na ion from Na2.

SUPPORTED BY U.S. Dept. of Commerce, National Bureau of Standards

8.0004, THEORETICAL MOLECULAR PHYSICS
J.T. HOUGEN, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Washington, District of Columbia* 20234 (2320123)

OBJECTIVE: To develop theoretical techniques for relating experimental data to microscopic molecular properties. In particular, work under this project will address itself to 2 new areas of molecular research: (1) The theoretical analysis of far IR laser magnetic resonance data on free radicals important in atmospheric reactions and other kinetic processes; (2) Modeling of molecules containing heavy metal atoms of interest in molecular ion spectroscopy and metal vapor laser research.

APPROACH: The approach to this project is general for all theoretical modeling of observable molecular properties. (1) Derive a theoretical Hamiltonian which includes all microscopic interactions thought to be important. (2) Develop a convenient technique for computing observables. (3) Compare calculated observable for specific systems with available experimental information. (4) Use this comparison to improve the microscopic model.

SUPPORTED BY U.S. Dept. of Commerce, National Bureau of Standards

8.0005, LONG DURATION EXPOSURE FACILITY (HEAVY IONS IN SPACE)
M.M. SHAPIRO, U.S. Navy, Res. Laboratory, *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN880028)

To investigate the nature and properties of various components of HZE (high charge and energy) particle radiation in space. A better knowledge of the composition, intensity and energy spectra of HZE particles is necessary in order to evaluate their potential radiation damage to men and materials in space.

Passive plastic track detectors will be exposed to space radiations aboard NASA's LDEF (long duration exposure facility). Heavy ion beams at the LBL Bevalac accelerator will be used to calibrate the detectors. The experimental results will form the basis for follow-up experiments proposed for the space shuttle program.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

8.0006, MEASUREMENT OF BI-DIRECTIONAL REFLECTED SPECTRA AND CORRELATION TO AGRONOMIC PARAMETERS
R.A. WATLINGTON, Univ. of The Dist. of Columbia, Undergraduate School, *4100 Connecticut Ave. N.W., Van Ness Campus, Washington, District of Columbia* 20008 (NSG 5290)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0007, DEFECTS AND DISORDER PRODUCED BY ION IMPLANTATION IN SOLIDS
M. BALKANSKI, Univ. Paris, *2 Pl. Jussieu, Paris, France* (DA0D9372; DAERO 78 G0002)

Ion implantation is an important technique for doping semiconductors, vital to military electronics. The disordered layer produced by implantation is only partially restored by annealing, particularly in GaAs. The critical processes involved will be investigated.

The investigation will proceed in two steps: (1) The first step (18 months) will be related to low-medium dose (10 to the 12th power/10 to the 14th power at/cm sq) implanted S and Se in about 20 samples. These samples will be obtained from the same semi-insulating ingot; the thermal stability of this ingot will be characterized prior to implantation. The profile of defects just after implantation (Raman spectrum as a function of wavelength or chemical dissolution step by step) and the kinetics of recrystallization at low temperature (100 degrees C - 300 degrees c) will be determined. The role of an encapsulating layer (Si3N4 for example) will be studied and electrical characterization will be done after high temperature anneal (up to 950 degrees C). (2) The second step (18 months) will be related to high doses (10 to the 15th power-10 to the 17th power at/cm sq.) of implanted A1. This approach will benefit from the previous one. Implanted A1 profiles will be studied by SIMS just after implantation and after an annealing treatment at high temperature (900 degrees C). Doses and energies will then be defined in order to obtain a flat profile extending to 2000 A. Thermal recovery of the crystallization will be studied by Raman spectroscopy and luminescence.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Research & Standardization Group

8.0008, THEORETICAL STUDIES OF THE INTERACTION OF RADIATION WITH MATTER
S.T. MANSON, Georgia State University, School of Arts & Sciences, Physics, *33 Gilmer St. S.E., Atlanta, Georgia* 30303 (PHY76-80123)

Research in theoretical atomic physics initiated under NSF Grant PHY72-05156 A01 will be continued. This research will focus on: 1. Investigate within the framework of Born approximation, the energy and angular distribution of electrons ejected by fast charged particle impact ionization of atoms. 2. Calculate, within the same framework, inelastic scattering form factors, generalized oscillator strengths, and energy loss cross sections for

fast charged particle impact ionization of the atomic subshells of selected elements, as well as to determine their contributions to the total ionization cross section and stopping power. 3. Study the angular distribution of photoelectrons from open shell atoms, where the effects of anisotropic interactions play an important role, as well as other topics of interest in photoelectron spectroscopy such as satellite lines. 4. Explore the behavior of the cross section for the photoionization of selected excited states of various atoms. The results of the calculations will serve to provide further insight into the basic nature of these fundamental atomic processes which are of importance in plasma physics, atmospheric, solar, and astrophysics, radiation physics and for studies of the transport of energy from the site of thermonuclear reaction.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0009, ELEMENTARY-PARTICLE THEORY
R.J. OAKES, Northwestern University, School of Arts & Sciences, Physics, *633 Clark St., Evanston, Illinois* 60201 (PHY78-11607)

The proposed work is in the field of theoretical physics, with emphasis on studies of interactions of elementary particles at high energies. Specific topics which will be examined include calculations of: A) Production of charmed baryon pairs in electron-position annihilation; B) Exclusive cross sections for neutrino induced production of heavy quarks; C) Cross sections for pair production of intermediate vector bosons in pp and pp colliding beams; D) Weak interactions at extremely high energies with particular relevance to the DUMAND project.

This work is a continuation of that currently supported under NSF grant PHY7611445.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0010, MATERIAL SUPPORT TECHNOLOGY - DEEP IMPURITY LEVELS IN TERNARY SEMICONDUCTORS
J. DOW, Univ. of Illinois, School of Engineering, Physics, *2527 Hydrosystems Lab., Urbana, Illinois* 61801 (DN775630; N00014-77-C-0537)

Future Navy electronics systems will require improved and new semiconductor materials. Increased understanding of the role of impurities in these materials will result in better material control, cheaper materials and new electron device application.

This research will further develop the theoretical and experimental understanding of the role of the isolelectronic impurity nitrogen in the ternary alloy semiconductor gallium-arsenide-phosphide (GaAsP). A phenomenological model has elucidated some of the mechanisms involved in the high efficiency photoluminescence of this material. The deformation potentials for such impurities will be calculated for an anisotropic medium to remove part of the phenomenology of the earlier model. These will be used to calculate binding energies for various nitrogen-nitrogen pairs and to see if excition binding is due to the dilatation of the lattice. By varying the alloy ratio, the effect of arsenic (As) on the activation energies of various luminescence lines and the quenching of intensity by increasing the As content can be investigated. Since luminescence appears to originate from excitonic molecular complexes, the exciton-exciton interaction energies will be investigated. Other impurities and compounds will be investigated as the ideas and concepts are developed.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0011, THEORETICAL PARTICLE PHYSICS
D.G. RAVENHALL, Univ. of Illinois, Graduate School, Physics, *Urbana, Illinois* 61801 (PHY77-25279)

Work is proposed on a broad range of topics: QUANTUM FIELD THEORY. A common area for many of the group, the items focus on various aspects of gauge theories: instantons, gluons and infra-red problems, and lattice quantization. There are other more general items: path integrals for fermion fields, and a phi 4 theory with strong and weak coupling limits, as a testing ground for nonperturbative methods. Studies related to this work involve solitions and nonlinear partial differential equations. ELECTROMAGNETIC AND WEAK INTERACTIONS. Studies of a general nature include the connection between generalized vector-meson dominance and partons, and violations to scaling laws. Those stimulated by particular experiments include di-lepton production rates in e e collisions and production of nucleon resonances through neutral current interactions. STRONG-INTERACTION PHENOMENOLOGY. A large part of this effort, associated to some extent with Illinois experimental work, is the study of resonances in a three-pion system and the production of charmed and psi particles. NUCLEAR PHYSICS AND SCATTERING. A new area of interest involves nucleon-physics effects on particle production processes in nuclei. There is continued development of coupled-channel techniques and associated phenomna, as well as application to current scattering experiments and application of simple nuclear models to astrophysics.

This work is a continuation of that currently initiated under NSF grant PHY75-21590 A02.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0012, OPTICAL PROPERTIES OF SOLIDS
L.L. CHASE, Indiana University, School of Arts & Sciences, Physics, *Memorial Hall, Bloomington, Indiana* 47401 (DMR78-09426)

Experimental investigations of light scattering and laser spectroscopy of solids previously supported by NSF grant DMR-7609091 will continue. The studies will concentrate on the two problem areas: (1) Impurity-induced Raman scattering measurements of coupled electronic and vibrational excitations for impurities with degenerate, or nearly degenerate, ground states; (2) Two-photon absorption and induced absorption studied of excitons and exciton interactions in wide band-gap semiconductors. In addition, light scattering studies of impurity-induced ferroelectric phase transitions in KTaO3, primarily at low impurity concentrations will be initiated. These studies of optical scattering in solids using laser radiation are directed toward providing an improved understanding of electronic and vibrational dynamical effects in insulators and wide band gap semiconductors.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0013, LIGHT-SCATTERING STUDIES OF PHONON INTERACTIONS IN PIEZOELECTRIC SEMICONDUCTORS
R. BRAY, Purdue University, School of Science, Physics, *Executive Bldg., Lafayette, Indiana* 47907 (DMR76-82090 A01)

The following research projects will be carried out: (1) Brillouin scattering of reflected light experiments, in order to determine the mechanism of reflected light scattering for bulk phonons. (2) X-ray scattering studies of amplified phonon beams and laser-generated phonons. (3) Studies of the effects of intense laser radiation on the Raman spectrum in order to check the current concepts relating to the electron-optical phonon interaction. (4) Modulation of the Raman spectrum by acoustoelectric domains, in order to study the effect of piezoelectric fields on the optical phonon lines.

Reference: DMR74-17606 A01.

This is the first year of a 2-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0014, EXPERIMENTS ON SPIN ALIGNED ATOMS
W.C. STWALLEY, Univ. of Iowa, School of Liberal Arts, Chemistry, *Jessup Hall, Iowa City, Iowa* 52240 (NSG 7471)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0015, INTERNATIONAL STUDY GROUP ON THE VERY BIG ACCELERATOR
H. FESHBACH, Mass. Inst. of Technology, School of Science, Physics, 77 *Massachusetts Ave., Cambridge, Massachusetts* 02139 (PHY76-20724)

A series of several day meetings by the International Study Group on the Very Big Accelerator will be held over the next three years at sites located in the U.S., Western Europe and the U.S.S.R. to consider possibilities for an international project to design and construct a very large accelerator. The NSF, together with ERDA, will provide funds for the American portion of the cost of these meetings, including travel expenses for American participants while abroad. Studies of the type being proposed are essential for adequate and appropriate planning of future facilities in the area of Elementary Particle Physics and form the basis for definitive proposals to construct major new scientific facilities.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0016, ATOMIC AND MOLECULAR PHYSICS
D. KLEPPNER, Mass. Inst. of Technology, School of Science, Physics, 77 *Massachusetts Ave., Cambridge, Massachusetts* 02139 (PHY77-09155 A01)

Research in three broad areas is proposed: van der Waals molecular spectroscopy, scattering of laser excited atoms, and high excited atoms. Laser resonance fluorescence spectroscopy will be used to determine the ground and first few excited-state interatomic potentials in sodium-rare gas van der Waals molecules (NaNe is currently under investigation). A new technique for state-specific angle differential scattering, based on the Doppler shift, will be attempted and applied to fine structure changing collisions in a sodium-rare gas system for which the potentials are spectroscopically determined. Recently developed techniques involving Rydberg atoms will be exploited in order to study the structure of atoms in very high magnetic fields, and also static and dynamic effects of core polarization. A number of other topics involving Rydberg atoms will be investigated including a study of some of the systematics of a proposed experiment to measure the Rydberg constant.

This work is a continuation of that currently supported under NSF grant number MPS75-15421A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0017, OBSERVATION OF LUMINESCENT SPECTRA IN LOW ENERGY ION-NEUTRAL COLLISIONS
J.J. LEVENTHAL, Univ. of Missouri, School of Arts & Sciences, Physics, *8001 Natural Bridge Rd., St. Louis, Missouri* 63121 (EY-76-S-02-2718)

The objective of these experiments is to obtain detailed information on the internal excitation energy of atoms and molecules after undergoing nonviolent (low energy) collisions. The experiments are performed by spectral analysis of the light emitted by the atoms and molecules following collision. From these spectra microscopic details of the collision mechanism can be determined; that is, the amount of energy stored in the molecular collision products as well as the partitioning of energy among the available internal energy levels. Subsequent studies will concentrate on collisions in which one of the colliding species is laser excited to a specific internal energy state. Collisions of this type are, in some cases, expected to react in a highly selective fashion and have been mentioned as a possible method of isotope separation.

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

8.0018, BETA DECAY CLOCK EXPERIMENT
K.L. NORTDVEDT, Montana State University, School of Letters & Sciences, Physics, *Bozeman, Montana* 59715 (NSG 8061)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0019, AURORAL ELECTRON INTERACTIONS
R.L. KAUFMANN, Univ. of New Hampshire, School of Technology, Physics, *James Hall, Durham, New Hampshire* 03824 (ATM77-01014)

This grant will extend the use of magnetometer and energetic particle data to investigate several problems associated with auroral electron acceleration and magnetohydrodynamic wave generation. A number of university groups will be working on various aspects of these topics, particularly during the International Magnetospheric Study period. The effort supported here will make a significant contribution to this worldwide effort. First priority is to fully utilize Dr. Arnoldy's rocket measurements of the auroral electron distribution function. These data will allow a study of the stability properties of the auroral plasma at rocket altitudes. When the plasma is unstable, it is possible to determine which wave mode should grow most rapidly. More frequently the plasma is just barely stable. At such times, a similar analysis will show which wave modes were unstable at higher altitudes. The waves presumably modified the electron distribution function through nonlinear processes until it reached the observed marginally stable state. These calculations should provide a good test of several aspects of plasma stability theory. In this sense, the work will represent one important step in attaining the goal of utilizing the magnetosphere as a plasma physics laboratory. The overall aim is to understand auroral precipitation.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

8.0020, THEORY OF PHASE TRANSITIONS IN RANDOM SYSTEMS
M.J. STEPHEN, Rutgers The State University, School of Arts & Sciences, Physics, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (DMR78-10276)

Research previously supported by DMR75-13350.

Theoretical research in condensed matter physics will be carried out. The main emphasis will be on the application of renormalization group methods to phase transitions in random systems. Of particular interest are those systems exhibiting strong randomness near the percolation threshold. Among the topics to be considered will be (a) pure percolation problems, (b) phase transitions in random magnets near the percolation threshold, and (c) the conductivity of random resistor networks and its relation to phonons in a random lattice and spin waves in random ferromagnets.

This research will enhance the understanding of the behavior of an important class of materials, i.e., disordered solids, under conditions near a phase transition.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0021, OBLIQUE MAGNETIC FOCUSING
J.L. LOWRANCE, Princeton University, Graduate School, Astrophysical Sciences, *205 Nassau Hall, Princeton, New Jersey* 08540 (NSG 5277)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0022, MEASUREMENTS OF FORBIDDEN REFLECTIONS IN GERMANIUM AND SILICON USING SYNCHROTRON RADIATION
B.W. BATTERMAN, Cornell University, School of Engineering, Materials Science, *242 Carpenter Hall, Ithaca, New York* 14850 (DMR78-11636)

X-rays scattered by bonding electrons in diamond, silicon and germanium will be used to determine the spatial distribution of these bonding electrons. These experiments are of interest to many in solid state physics who are concerned with the detailed electronic behavior and location in these semiconductors. X-rays are reflected from crystals in certain well defined directions which are determined by the lattice spacing, the x-ray wave length and the direction of the incident x-ray beam. Some reflections are

forbidden by the atomic arrangements in the crystal, but are weakly allowed because of the asymmetric distribution of charge about the atoms and due to the anharmonic motion of the core electrons about their equilibrium position. Observations of these forbidden electrons can lead to a much more precise determination of the electronic spatial distribution in the bonds between atoms. These results can be compared to the calculated charge distributions. Synchrotron radiation from the Cornell Electron Storage Ring (CESR) will be used as an x-ray source for this experiment and will make considerable improvement in experimental accuracy possible.

This is a continuation of the research supported by DMR-7302384.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0023, ELECTRON SPIN REASONANCE

R.H. SILSBEE, Cornell University, School of Physical Sciences, Physics, *Ithaca, New York* 14850 (DMR77-08464 A01)

Applications of the method of electron spin resonance to problems in solid-state physics previously supported by DMR-7420689 will be continued. The work progress focusses on the use of transmission electron spin resonance in metals using a variety of bilayer or multilayer samples. Three experiments are of specific interest. The first involves measurements on copper-ferromagnetic bilayers using alloy (palladium-iron) films of controllable Curie temperature with the aim of verifying existing models for spin coupling at the interface. A second is the study of the spin lattice relaxation process in polyvalent metals. The third involves developing a characterization and understanding of the interfacial boundary conditions for spin transport at the interface between a normal and a superconducting metal.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0024, SURVEILLANCE - ATOMIC COLLISION PROCESSES OCCURRING IN THE PRESENCE OF RADIATION FIELDS

P.R. BERMAN, New York University, School of Arts & Sciences, Physics, *421 1ST Ave., New York, New York* 10012 (DN775683; N00014-77-C-0553)

The technical objective of this contract is to study the interaction of radiation with atoms or molecules that are simultaneously undergoing collisions. This work is important to the Navy because it will provide the necessary theoretical underpinning of several new experimental laser spectroscopic techniques and may also lead to the prediction of new optical effects.

The technical approach will involve the study of two problems. The first, collisions in three-level systems will involve the determination of the effects of collisions when a three-level atomic or molecular system is subjected to pump and probe laser radiation. The second problem, dynamical effects in optical and radiative collisions, will lead to a fundamental formulation of collisionally aided radiative processes and radiatively aided collisional processes. This second study will differ from previous ones in that it will concentrate on possible dynamical interference effects.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0025, A THEORETICAL INVESTIGATION OF ATOMIC SCATTERING PROCESSES

L. ROSENBERG, New York University, School of Arts & Sciences, Physics, *421 1ST Ave., New York, New York* 10012 (PHY77-10131)

Research in theoretical atomic physics initiated under NSF grant PHY75-00131 A01 will be continued. Among the topics to be investigated are: 1. variational principle for the scattering length; 2. electron atom scattering in the presence of a laser field; 3. double scattering processes; 4. variational methods for matrix elements; 5. expansion of matrix elements in powers of l/k; 6. upper and lower variational bounds.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0026, QUANTUM FIELDS AND STATISTICAL MECHANICS

J. GLIMM, Rockefeller University, Graduate School, Physics, *York Ave. & 66th St., New York, New York* 10021 (PHY78-08066)

The proposed work is in the combined areas of theoretical physics and applied mathematics. Problems in quantum fields and statistical mechanics will be studied using correlation inequalities, expansion methods, classical solutions, and renormalization group methods. The role of mesons in quark confinement will be examined. In nonequilibrium statistical mechanics the approach to equilibrium will be studied. In addition, investigations of shock waves may be pursued.

This work is a continuation of that currently supported under NSF grant PHY76-17191 A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0027, MATERIAL SUPPORT TECHNOLOGY - INTENSE ELECTRIC FIELDS AND MULTIPHOTON PHYSICS

J.H. EBERLY, Univ. of Rochester, School of Arts & Sciences, Physics & Astronomy, *260 Crittenden Blvd., Rochester, New York* 14627 (DN675671; N00014-76-G-0052)

The Navy requires an improved understanding of intense electromagnetic fields in the optical spectrum with matter and the nonlinear processes associated with this interaction.

This work unit provides partial support for an international conference on intense electromagnetic fields and multiphoton physics.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0028, CALCULATIONS OF SURFACE BINDING AND MOBILITY OF ADATOMS 14766-MS

H.B. HUNTINGTON, Rensselaer Polytechnic Inst., School of Science, Physics & Astronomy, *110 8TH, Troy, New York* 12181 (DA0F9179; DAAG29-78-G-0065)

To theoretically approach the surface binding and mobility of adatoms, taking into account the metal surface structure, driving force for electromigration, and the influence of the adatoms on the electronic work function of the metal in order to achieve a simplified model of adatom-surface interactions. Relevance - catalysis, corrosion, oxidation, chemical vapor deposition on surfaces, and degradation of stability in printed circuit components of electronic equipment.

Investigation of the surface problem of simple, nearly free electron metals using the density functional formalism. Investigate the implications of the revised kinetic energy model on the binding energies of various metals of different charge densities. Study of the influence of close packed and low density planes. Calculations modeling situations of movement of impurity atoms across a surface, and electromigration along a free surface.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0029, CURRENT CONTROLLED LIQUID PHASE EPITAXY

E.K. STEFANAKOS, Univ. of North Carolina, Graduate School, *N. Dudley St., Greensboro, North Carolina* 27411 (DMR77-19210)

This research will be a study of semiconductor crystal growth by current controlled liquid phase epitaxy (LPE), a method of producing high quality junctions and uniform epitaxial layers. The work will concentrate on the mechanisms responsible for the growth of epitaxial layers by current flowing across the semiconductor-melt interface. Two possibilities are: (a) diffusion of solute atoms to the interface in the presence of a temperature gradient, and (b) differential ion migration resulting from momentum exchange between electrons and solute atoms. The temperature and temperature gradient at the interface will be carefully measured by introducing thermocouples at about 0.5 mm intervals from the interface. This method will be used to grow epitaxial

layers of indium arsenide on indium arsenide, indium phosphide on indium phosphide and gallium indium arsenide on indium phosphide.

After growth, specimens will be cleaved and examined with a phase contrast microscope to determine interface uniformity, thickness of grown region and presence of any strictions due to current pulses. In addition, Schottky barrier methods will be used for profile measurements.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0030, THE STRUCTURE AND LATTICE DYNAMICS OF MONOLAYERS ON CRYSTALLINE SUBSTRATES

A.D. NOVACO, Lafayette College, Undergraduate School, Physics, *Easton, Pennsylvania* 18042 (DMR75-15630 A01)

A theoretical study will be made of the structure and lattice dynamics of monolayer films on crystalline substrates. These systems are examples of two-dimensional displacive incommensurate solids, with the incommensurate structure in the monolayer being driven by the substrate. A variety of systems will be examined, some being treated with perturbation theory and some with an extended version of the self-consistent phonon approximation.

Research previously supported by DMR75-15630.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0031, GENERAL RELATIVITY AND ASTROPHYSICS

P. HAVAS, Temple University, School of Liberal Arts, Physics, *Broad St. & Montgomery Ave., Philadelphia, Pennsylvania* 19122 (PHY77-28356)

A research program in theoretical gravitation will be initiated. Among the topics to be investigated are: A. General Relativistic Dynamics; 1. Test particles; 2. Approximate equations of motion. B. Relativistic Thermodynamics; C. Electromagnetic and Gravitational Waves in Curved Space; 1. Radiation from pulsating neutron stars; 2. Radiation from rotating neutron stars; 3. Gravitational and neutrino waves.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0032, OPTICAL AND ACOUSTICAL SPECTROSCOPY OF SOLIDS

E. BURSTEIN, Univ. of Pennsylvania, School of Arts & Sciences, Physics, *34th & Spruce Sts., Philadelphia, Pennsylvania* 19104 (DN723089; N00014-76-C-0107)

The interaction of electromagnetic waves with solids yields information for developing new solid state materials for ir detectors, windows, and electronic devices which will find application in naval electronic, communication, and surveillance systems.

Surface electromagnetic waves and surface acoustic waves and their interactions with electrons in solids and with each other are studied to give the electrical properties of solid state materials. The interaction of surface electromagnetic waves (polaritons) with anisotropy dielectric and permeable solids will be studied via techniques such as attenuated total reflection (ATR). In addition, funds are provided for the partial support of U. S. travellers to the International Conference on Lattice Dynamics to be held 5-10 September 1977 in Paris.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0033, CHARGE EXCHANGE COLLISIONS OF HIGHLY STRIPPED IONS WITH ATOMIC HYDROGEN

J.E. BAYFIELD, Univ. of Pittsburgh, School of Arts & Sciences, Physics & Astronomy, *4200 5TH Ave., Pittsburgh, Pennsylvania* 15260 (EG-77-S-02-4257)

New double tandem accelerator techniques will be used to study charge exchange of totally stripped C, N, and O ions as well as highly stripped Ni and Fe ions. The excited state content of ion beams produced by charge exchange will be investigated using kinetic energy analysis.

RESULTS: Cross sections have been measured for partially stripped B, C, N, O, Si and Fe ion collisions with H, H2, He and Ar. Kinetic energy analysis of B3 ion produced in B4 ion-Ar collisions has been accomplished. Highly stripped ions have been decelerated to lower energies using a double tandem accelerator.

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

8.0034, SPECIAL FOREIGN CURRENCY AWARD FOR STUDIES OF PHASE TRANSITIONS AND MOLECULAR MOTIONS IN LIQUID CRYSTALS

J. JANIK, Inst. of Nuc. Phys. & Techniq., *30 Aleje Mickiewicza, 31-342, Cracow, Poland* (INT75-01318)

This proposal for a collaborative research between the Institute of Nuclear Physics, Krakow, Poland, and Kent State University describes several experimental approaches to the study of selected liquid crystal and solid phases and phase transitions which occur in the double homologous series 4-n-alkoxybenzylidene-'-alkylamines. Studies of orientational order are described. Of particular interest is rotation of the molecule or groups of molecules about the longitudinal axes. Dielectric measurements and far-infrared-versus-time measurements to obtain high frequency (GHz) absorption regions interpreted as Debye or Poley absorptions are to be made to provide information on the correlation time of molecular rotation. The same information on correlation times will be supplied independently by measurements of line profiles in the infrared where there exists the additional possibility of distinguishing the rotation of individual groups by a correct choice of frequency bands. Adiabatic calorimetric measurements are proposed. In this study particular attention is to be paid to the specific heats in the solid phases. In particular the proposed calorimetric study of metastable solid phases such as the one found in MBBA, when coupled with the infrared and dielectric relaxation studies, will help to sort out the reasons why such metastable phases exist from the point of view of molecular dynamics.

SUPPORTED BY U.S. National Science Foundation, Div. of International Programs

8.0035, NUCLEAR MAGNETIC RESONANCE STUDIES OF THE STRUCTURE OF GLASSES

P.J. BRAY, Brown University, Graduate School, Physics, *University Hall, Box 1867, Providence, Rhode Island* 02912 (DMR77-08600 A01)

New developments utilizing NMR studies to answer basic scientific questions concerning glass structure will be carried out including the following projects: (1) The O17 NMR spectroscopy of glasses will be used to study oxygen bonding in the alkali borate and silicate systems. (2) Si29 NMR spectroscopy will be completed for glasses and compounds of the system K2O-SiO2 and applied to other alkali and alkaline earth binary silicates and ternary systems. The linewidths and isotropic chemical shifts will also be determined. (3) Newly-developed B10 NMR spectroscopy will be applied to several binary and ternary systems (e.g., Li2O-B2O3 and Na2O-B2O3-SiO2). (4) Recent success in using NMR spectra to determine the structure of glasses in ternary systems will be extended to the systems Na2O-B2O3-SiO2, CdO-TeO-B2O-V2O5, La2O3-B2O3-CdO and K2O3-P2O5. (5) Ionic motion in glasses will be studied by NMR to determine activation energies, extend present studies of diffusion in systems based on SiO2 and B2O3 to glasses based on other oxides and more novel constituents, and test theories for the mixed-alkali effect.

This is a continuation of research begun under NSF Grant No. DMR76-07814.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0036, PHASE TRANSITIONS, CLUSTERING TENDENCIES AND ELECTRONIC PROPERTIES OF NON-CRYSTALLINE MATERIALS

J.C. THOMPSON, Univ. of Texas, School of Natural Sciences, Physics, *200 W. 21st St., Austin, Texas* 78712 (DMR76-84338 A01)

This research concerns the electronic energy levels in fluid materials s solutions or alloys - wherein the change of composition, density or temperature can cause a change of the electronic wavefunction from extended, as in a metal, to localized, as in a semiconductor, electrolyte or other nonmetal. The change in the nature of the wave function is reflected in changes in conductivity, Hall coefficient, and optical properties. These are measured. Any concomitant changes in chemical association or phase transitions are determined from measurements of chemical potential. Systems studied are based on alkali metals in combination with liquid NH3, liquid chalcogenides such as Te, or similar materials. In the long range, this work is directed toward understanding the metal-nonmetal transition.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0037, THEORETICAL CALCULATIONS RELEVANT TO HYDROGEN STORAGE

A.L. FORD, Texas A & M University System, School of Science, Physics, *College Station, Texas* 77843 (NSG 3201)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0038, PHOTON APPEARANCE POTENTIAL SPECTROSCOPY OF DYSPROSIUM

D.R. CHOPRA, East Texas State University, School of Science & Technology, Physics, *E. Texas Station, Commerce, Texas* 75428 (T-643)

The photon appearance potential spectra (APS) of M4,5 and N4,5 levels of rare-earth dysprosium have been obtained in 130-1400-eV range with a simple nondispersive spectrometer which measures the derivative of the total x-ray fluorescence yield of the sample surface as a function of bombarding electron energy. The spectra represents the differential excitation probability of 3d and 4d core levels and provides information regarding the position of 4f states relative to the Fermi energy. The M5 peak exhibits two distinct components, 1.8 eV apart, accompanied by subsidiary structures clustering about the expected position of the M5 edge. The N4,5 spectrum is, however, more complex consisting of a rich resonance structure superimposed on a broad continuum which extends 18.3 eV above the threshold. The most intense peak of the superstructure appears at 9.0 eV above the absorption edge. The spectral features have been interpreted in terms of the excitation states arising as a result of the exchange interaction between the 4f electrons and 3d and 4d vacancies. The binding energies of M4M5 and N4,5 core levels of Dy surface atoms were measured to be a few eV lower than the published values.

SUPPORTED BY Robert A. Welch Foundation

8.0039, QUANTUM GRAVITY AND RELATIVISTIC ASTROPHYSICS

K.V. KUCHAR, Utah Higher Education System, School of Science, Physics, *1400 &. 2ND S., Salt Lake City, Utah* 84112 (PHY78-05368)

Research in gravitation theory initiated under NSF grant PHY74-16311 AO4 will continue. Among the topics to be investigated are: Quantum Gravity: 1. 2 plus 1 Gravity with scalar source; 2. Statistical operator description of quantum fields in curved spacetimes; 3. Wigner-Moyal formalism in quantum geometrodynamics; 4. Conformal structure of superspace; 5. Derivative gravitational coupling. Relativistic Astrophysics: 1. Radiation from collapsing relativistic stars; a) linearized even-parity perturbations, b) astrophysical models, c) second order perturbations; 2. Detectability of pregalactic black holes; 3. Distorted static event horizons; 4. Interaction of gravitational radiation with a Newtonian binary system; 5. Gravitational collapse of a globular star cluster.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0040, RADIATION EFFECTS STUDIES FOR THE HIGH RESOLUTION SPECTROGRAPH

J. BECHER, Old Dominion University, School of Sciences & Health, Physics, *P.O. Box 6173, Norfolk, Virginia* 23508 (NSG 5289)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0041, THEORETICAL STUDIES OF CHEMICAL REACTIONS INVOLVING EXCITED ELECTRONIC STATES

J.B. DELOS, Coll. of William & Mary, School of Arts & Sciences, Physics, *Ewell Hall, Williamsburg, Virginia* 23185 (CHE78-01595)

A number of fundamental difficulties have arisen in the theory of electronic excitations in molecular collisions. The conventional form of the theory leads to certain symmetry-violating couplings, unphysically large collision cross-sections for some processes, and inappropriate asymptotic behavior of some matrix elements. Many of these were resolved by Professor Delos' development of a quantum form of 'electron-translation-factors,' which describe the motion of the electrons as they are carried with the nuclei. These seemingly unimportant factors were found to have substantial effects which resolve the above-mentioned difficulties and lead to corrections to many coupling matrix elements. Continued investigations on the effects of these factors are planned, especially seeking numerical tests of the new form of the theory.

Collisions involving electron detachment have in the past been described by a 'complex-potential' model, but the simplest forms of this model are not in agreement with all the experimental data. A more general approach to the theory of these processes is being developed, and will be used to calculate the cross-sections (and corresponding rate constants) for elastic scattering and electron detachment, and the energy and angular distribution of detached electrons.

This research represents a continuation of that currently supported by Foundation grant CHE-7516119.

SUPPORTED BY U.S. National Science Foundation, Div. of Chemistry

8.0042, QUANTUM THEORY FOR REACTIVE AND DISSOCIATIVE ATOM-MOLECULE SCATTERINGS

K. TANG, Pacific Lutheran University, School of Arts & Sciences, Physics, *P.O. Box 2068, Tacoma, Washington* 98447 (9173-AC6)

We propose to develop an efficient way to make general three-dimensional quantum mechanical calculations of reactive and dissociative atom-molecule scatterings. We have developed the adiabatic distorted wave method for reactive scattering from ground initial state to arbitrary final state. Compared with the recent close-coupling calculation results of Shatz and Kuppermann, this method seems to give the correct total and differential cross sections in the entire thermal energy region. Using the fact that the potential has to be rotationally invariant, we have analytically integrated out the three Euler angles describing the rotation of the whole system. Thus the problem is reduced in complexity by more than two orders of magnitude as measured by the computer time required to carry out such calculations.

We propose to refine and extend this model so that we can treat the general reactive collisions with any rotational and vibrational transitions.

For dissociative scatterings, we propose to investigate the practical ways of using the formal theories of three-particle wave functions recently developed by E. Gerjuoy and R. Newton. We shall use our reactive scattering model as a framework for carrying out actual numerical calculations for collisionally-induced molecular dissociations.

SUPPORTED BY American Chemical Society

8.0043, GRAVITY, QUANTIZED FIELDS, AND RELATIVISTIC ASTROPHYSICS
L. PARKER, Univ. of Wisconsin, School of Letters & Science, Physics, *Pearse Hall, Room 107, Milwaukee, Wisconsin* 53221 (PHY77-07111)

Research initiated under NSF Grant PHY72-05161 A02 will be continued. In addition to the areas of research under the previous grant, new topics in relativistic astrophysics will be investigated. John Friedman, who has recently joined the university as an Assistant Professor, is included in the present project as co-investigator.

Research under way on vacuum polarization and particle creation by strong gravitational fields will continue. Work on the quantum treatment of the damping of expansion anisotrophy in the early universe will be generalized and extended. A new type of infrared divergence occurring for quantized gravitational and scalar fields will be investigated. Other topics in quantum field theory on curved backgrounds will also be studied.

Research on the analogue for curved space-time of the Dirac charge quantization condition will be continued. A related area of research involves quantizing test electromagnetic fields on curved space-times with non-trivial topologies. The possible existence of spinor fields acted on by the group of diffeomorphisms on a space-time will also be investigated.

In recent work, John Friedman showed that all rotating Newtonian stars are unstable or marginally unstable to gravitational radiation; a key aim of his current research is to establish analogous results in general relativity.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

SOCIAL SCIENCES

Includes Social Sciences (general); Administration and Management; Documentation and Information Science; Economics and Cost Analysis; Law and Political Science; and Urban Technology and Transportation.

9.0001, A COMPREHENSIVE ANALYSIS OF HUMAN PERFORMANCE REQUIREMENTS FOR FUTURE SPACE FLIGHT
A.A. HARRISON, Univ. of California, School of Letters & Science, Psychology, *Davis, California* 95616 (NCA 2-180803)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

9.0002, GODDARD INTRODUCTION TO ENGINEERING CAREERS
E.L. COX, Howard University, School of Engineering, Electrical Engin, *2400 6TH St. N.W., Washington, District of Columbia* 20001 (NCA 5-29)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, HIGH RESOLUTION TRANSMISSION ELECTRON MICROSCOPY OF LUNAR PYROXENES
P.R. BUSECK, Arizona State University, School of Liberal Arts, Geology, *Tempe, Arizona* 85281 (NSG 9068)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0002, CONTINUED DEVELOPMENT OF INFRARED SPATIAL INTERFEROMETRY
F.J. LOW, Univ. of Arizona, School of Liberal Arts, Astronomy, *Tucson, Arizona* 85721 (AST77-01261 A01)

Spatial interferometry offers the hope of achieving angular resolution ten times better than conventional observations in the infrared region of the spectrum. Such improvement will allow detailed comparisons with observations at visible and millimeter wavelengths which are vital to understanding the physical processes involved in a wide range of celestial objects.

A spatial interferometer has been constructed and successfully used at the University of Arizona. Using this instrument the limitations imposed by the earth's atmosphere will be studied in various wavelengths ranging from 2 to 20 microns. The instrument will be improved by the addition of a second baseline to more than double the instrumental efficiency. Methods of increasing the usable baseline, and hence, improving the obtainable resolution will be explored.

Observations will be made of circumstellar dust shells, stars and planetary systems in the process of formation and the nuclei of energetic galaxies.

This is a continuation of work supported under NSF grant MPS 75-00530.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0003, STRUCTURE OF STELLAR SYSTEMS
I.R. KING, Univ. of California, School of Letters & Science, Astronomy, *Berkeley, California* 94720 (AST76-00530 A02)

The research involves the study of the structure of various types of stellar systems, including stars in the local neighborhood. The local galactic structure project has two parts: a) Magnitudes and colors of faint stars will be analyzed to determine the local density of dwarf stars, their local density gradient, and their luminosity functions. The study will distinguish between stars inhabiting the galactic disc and the galactic halo. b) Proper motions of these same stars will be measured and re-analyzed.

Magnitudes and colors of faint galaxies will be measured in several regions on the sky, and their distribution will be analyzed. The results will bear on the value of the deceleration parameter, the homogeneity of the universe, the evolution of galaxies, and their luminosity function.

Another project is a study of the dynamics of star clusters. Properties of detailed dynamical models will be studied, particularly with regard to the interaction of stars of different masses.

This action provides additional funding to grant AST 76-00530A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0004, COSMIC MICROWAVE BACKGROUND ISOTROPHY RESEARCH
G. SMOOT, Univ. of California, Space Sciences Laboratory, *3 Leuschner Observatory, Berkeley, California* 94704 (NSG 7455)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0005, PROBLEMS OF MASS LOSS AND MASS TRANSFER IN CLOSE BINARY SYSTEMS
M. PLAVEC, Univ. of California, School of Letters & Science, Astronomy, *405 Hilgard Ave., Los Angeles, California* 90024 (NSG 5272)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0006, MAGNETIC AND VELOCITY FIELD OF FACULAE IN COLLABORATION WITH OSO-1
G. CHAPMAN, Calif. State Univ. & Colleges, Graduate School, *1811 Nordhoff St., Northridge, California* 91326 (NSG 7456)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0007, RADAR STUDIES OF THE MARTIAN SURFACE
G.L. TYLER, Stanford University, School of Engineering, Electrical Engin, *Palo Alto, California* 94305 (NSG 7395)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0008, SPECTRAL CHARACTERIZATION OF ANALOGS TO THE MARTIAN RECOLITH
A.L. ALBEE, Calif. Inst. of Technology, Graduate School, Geology, *1201 E. California Blvd., Pasadena, California* 91109 (NSG 7442)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0009, THE AMES PLANETARY BOUNDARY LAYER MODEL
R.D. BORNSTEIN, Calif. State Univ. & Colleges, School of Science, Meteorology, *Washington Sq., San Jose, California* 95114 (NSG 2314)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0010, SPECTROSCOPIC STUDIES OF INTERSTELLAR MATERIAL AND VERY YOUNG STARS
G.H. HERBIG, Univ. of California, Graduate School, Astronomy & Astrophysics, *Santa Cruz, California* 95060 (AST77-26404)

This grant will provide support for a broad program of spectroscopic studies on interstellar material and very young stars. The work will be carried out using a variety of instruments: a very high-resolution echelle scanner, a 3-channel coude spectrometer, and a conventional image-intensifier photographic spectrograph. At the highest resolution a systematic search will be made for very weak interstellar lines of molecules and molecular ions; of fine structure and Doppler shifts in the diffuse interstellar absorption bands; of the lithium isotope ratio in stars; and of line broadening in slowly-rotating solar-type stars. The conventional spectroscopy will be devoted to the study of the suspected spectroscopic binaries among the T Tauri stars, and to an effort to identify post T Tauri, pre-main sequence stars in young clusters and the field. Funds will be provided for up-grading the echelle computer and calibration system, and for construction of an integrating TV system.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0011, BASIC RESEARCH IN STELLAR AND SOLAR PHYSICS
R. THOMAS, Univ. of Colorado, Graduate School, *1200 University Ave., Boulder, Colorado* 80302 (NSG 7460)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0012, ANALYSIS OF NEW HIGH RESOLUTION SOLAR SPECTRA IN THE 2.5 TO 15UM REGION
A. GOLDMAN, Univ. of Denver, School of Arts & Sciences, Physics & Astronomy, *2115 S. University Blvd., Denver, Colorado* 80210 (ATM76-83908)

Ground-based high resolution solar spectra in the 2.5 to 15UM region will be the basis of a new atlas of atmospheric absorption lines. The atlas will include spectra at 0.06 cm to the minus one power resolution obtained recently from Denver (1.6 km) and the nearby Mount Evans (4.3 km), at both high sun and low sun, and additional spectra to be obtained at these sites. The low sun spectra greatly enhance the sensitivity limits for detection of trace constituents. The spectra will be quantitatively analyzed for the spectral absorption lines and compared with theoretical line parameters.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

10.0013, EXPANSION OF THE SOLAR WIND FROM CORONAL HOLES
Y.C. WHANG, Catholic University of America, School of Engin. & Arch., Mech Engin, *620 Michigan Ave. N.E., Washington, District of Columbia* 20017 (NSG 7422)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0014, AN OBSERVATIONAL INVESTIGATION OF THE NATURE AND EVOLUTIONARY STATUS OF THE RS CANUM VENATICORUM ECLIPSING BINARY STARS
F.B. WOOD, State University of Fla. Sys., School of Arts & Sciences, Astronomy, *204 Tigert Hall, Gainesville, Florida* 32601 (AST76-17591 A01)

The RS Canum Venaticorum eclipsing binary stars present many interesting problems relative both to stellar structure and to stellar and binary evolution. A program of continued systematic observation of the light curves of these stars will be carried out. Emphasis will be placed on understanding the structure and evolutionary status of these stars by carefully analyzing light curves and the changes in these light curves. Photoelectric photometry will be carried out using the 18 and 30 inch telescopes of Rosemary Hill Observatory (University of Florida) and the 24 inch telescopes of Mount John University Observatory (Universities of Canterbury, Pennsylvania, and Florida) in New Zealand. A spectroscopic survey for new examples of the class in the southern hemisphere will be undertaken at Mount John.

Prior support was under NSF Grant AST 76-17591.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0015, A FINDING LIST FOR OBSERVERS OF CLOSE BINARIES (5TH EDITION)
F.B. WOOD, State University of Fla. Sys., School of Arts & Sciences, Astronomy, *204 Tigert Hall, Gainesville, Florida* 32601 (AST78-07507)

Support is for a new edition of the Finding List for Observers of Eclipsing Variable Stars; the 1963 edition of which has been an anachronism for more than 5 years. The editors contemplate a substantial broadening of the content of the Finding List so that it will more properly refer to Close Binaries, rather than only Eclipsing Variables. The source materials for the compilation are kept up to date at the University of Florida where the revision will be prepared. Camera-ready copy and the concomitant writing of the Finding List contents on magnetic tape will be undertaken for early publication and wide distribution.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0016, MINERALOGY OF THE SURFACES OF MERCURY AND MARS
J.T. JEFFERIES, Univ. of Hawaii, School of Arts & Sciences, Physics & Astronomy, *2444 Dole St., Room 101, Honolulu, Hawaii* 96822 (NSG 7443)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0017, ANALYSIS OF DEPTH PROFILES OF COSMIC RAY PRODUCTS IN ROCKS
G.P. RUSS, Univ. of Hawaii, Graduate School, *Spalding Hall, Room 359, Honolulu, Hawaii* 96822 (NSG 7423)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0018, OBSERVATIONAL STUDIES OF THE ATMOSPHERES OF EARLY-TYPE STARS
S.C. WOLFF, Univ. of Hawaii, Graduate School, *Spalding Hall, Room 359, Honolulu, Hawaii* 96822 (AST77-27404)

The analyses of the spectra of early type stars are essential to the studies of galactic structure, interstellar matter, stellar nucleosynthesis and evolution. Within the last decade our understanding of atmospheric structure and line formation processes has reached the point where it appears possible to use the observed spectra to obtain reliable diagnostics of the conditions prevailing in the atmospheres of these early stars. This research will be devoted to carrying out an observational program designed to provide photoelectric measurements at high resolution of the spectrum of such stars. A study of the line profiles due to elements such as hydrogen, helium and carbon will be made in order to test the model atmosphere calculations, to provide data which will be used as an input for further improvements in the theoretical models and to take advantage of the calculations already made to determine atmospheric parameters, rotational velocities, and helium abundances for early type stars.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0019, STUDIES OF THE ENERGY SPECTRUM OF COSMIC RAY ELECTRONS
D. MULLER, Univ. of Chicago, School of Physical Sciences, Physics, *5801 S. Ellis Ave., Chicago, Illinois* 60637 (NSG 7464)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0020, OBSERVATIONAL STUDIES OF MASS EXCHANGE BETWEEN STARS AND DIFFUSE MATTER IN GALAXIES AND ACTIVE BINARY SYSTEMS
J.S. GALLAGHER, Univ. of Illinois, Graduate School, *Urbana, Illinois* 61801 (AST77-18270)

Observational studies concerning interrelationships between stars and diffuse matter is presented. The research will primarily be divided between two major areas: 1. Cataclysmic Variable Stars. An emphasis will be placed on classical novae and on variable stars which share physical characteristics with novae. Specific problems will include evolution of the ejecta, abundances, and mass exchange in active binaries. 2. Optical structural characteristics of E, SO, and IO galaxies. Detailed information on internal structure and dynamics as well as the distribution of stellar populations will be needed for representative sample galaxies in order to properly assess variable atom hydrogen (HI) content in early-type galaxies. A program of optical spectrophotometry and direct broad-band and image intensifier H alpha photography has been chosen for the initial stages of this work.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0021, SEARCH FOR SPECTRA OF INTERSTELLAR MOLECULES AGAINST HOT STARS
L.E. SNYDER, Univ. of Illinois, School of Liberal Arts & Sci., Astronomy, *Urbana, Illinois* 61801 (NSG 5278)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0022, ANALYSIS OF X-RAY ASTRONOMY DATA
A.F. DAVIDSEN, Johns Hopkins University, School of Arts & Sciences, Physics, *Charles & 34th Sts., Baltimore, Maryland* 21218 (NSG 7449)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0023, THEORETICAL RESEARCH IN COSMOLOGY AND RELATIVITY
D.R. BRILL, Univ. of Maryland, School of Arts & Sciences, Physics & Astronomy, *College Park, Maryland* 20742 (PHY77-05299 A01)

Research will be carried out on problems in general relativity and cosmology. These problems include: (a) Mathematical and physical properties of maximal surfaces and of surfaces of constant mean curvature, (b) general properties of relativistic stars, (c) numerical integration of Einstein's equations.

This work represents a continuation of that currently supported by Foundation grant PHY70-02077 AO5.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

10.0024, NAVIGATION - TWO-COLOR REFRACTOMETER
D.G. CURRIE, Univ. of Maryland, School of Arts & Sciences, Physics & Astronomy, *College Park, Maryland* 20742 (DN775533; N00014-77-C-0541)

The objective of this work unit is to develop a new astronomical technique which will directly measure the effects of the atmosphere on the apparent positions of stars thereby allowing the determination of stellar positions with an accuracy significantly better than 0.1 arc-second in a single observation which is of interest to the Navy for improved navigation and guidance.

This experiment involves the measurement of the apparent position of a star at two widely separated wavelengths thereby permitting one to use the difference in apparent position to determine the total effect of the atmosphere on the apparent position of stars. Data will be taken under a variety of atmospheric conditions and locations. The validity of this approach will be determined by examining the internal consistency of the data as well as comparison with the results of other measurements where atmospheric effects have been corrected in other ways.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

10.0025, NUMERICAL SIMULATION EXPERIMENTS IN SUPPORT OF NASA SOLAR PHYSICS MISSIONS - SOLAR LOOP AND FLARE STUDIES
D.S. SPICER, Univ. of Maryland, Graduate School, *College Park, Maryland* 20740 (NSG 7427)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0026, EXPERIMENTS TO PROBE THE CHEMISTRY AND SURFACE ACTIVITIES OF THE MARTIAN SURFACE
K. BIEMANN, Mass. Inst. of Technology, School of Science, Chemistry, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NSG 7432)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0027, A PROGRAM FOR RESEARCH IN PLANETARY ATMOSPHERES
S.K. ATREYA, Univ. of Michigan, Graduate School, *Rackham Bldg., Ann Arbor, Michigan* 48104 (NSG 7404)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0028, STABILITY OF STARS AND CIRCUMSTELLAR FLOWS
R.F. STELLINGWERF, Rutgers The State University, Graduate School, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (AST77-26993)

Nearly all astronomical objects display some type of time variability. This variability is usually described in terms of various

types of instabilities, and powerful computer techniques have been developed to study these instabilities. The research is to be undertaken will involve work on the stability of the RR Lyrae and Cepheid variable stars, the study of mass infall and mass loss under various astronomical conditions, and studies of the effects of convection on the stability of pulsating stars.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0029, IRRADIATION EFFECTS ON SURFACE OF MOON, MERCURY, ASTEROIDS AND SOLAR SYSTEM BODIES

M.S. SPERGEL, City University of New York, Undergraduate School, Physics, *150-14 Jamaica Ave., Jamaica, New York* 11432 (NSG 7454)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0030, HIGH-RESOLUTION INFRARED SPECTROSCOPY OF INTERSTELLAR CLOUDS

B.L. LUTZ, State University of New York, Graduate School, *Stony Brook, New York* 11790 (AST76-04159 A01)

High-resolution studies of the visible and near-infrared spectra of moderately to heavily reddened early-type stars will be observed to study interstellar diatomic carbon (C2). A full observational program of the interstellar line spectrum of a star in Cygnus in which interstellar C2 has been identified will be carried out to study the interstellar chemistry in a dense optical cloud. This cloud is thought to be a transition state between the tenuous optical and dark radio clouds.

Additional observations of a star will be done to obtain a new upper limit of the C2 abundance to make a comparison with the cosmochemical models of Black and Dalgarno. Additional observations of the heavily reddened stars will be carried out to search for C2 in those regions.

The equipment to be used is the cassegrain echelle spectrography on the 60' reflector on Mt. Hopkins, Arizona, in conjunction with an image intensifier tube. Bright stars will be observed with PEPSIOS Fabry-Perot interferometer. The extension of the spectral data on the star in Cygnus will be carried out at Kitt Peak National Observatory with the Singer camera on the echelle spectrograph of the 4-meter telescope. A newly constructed cooled 3-stage image intensifier at Mt. Hopkins will also be used. Data reduction will be carried out at Stony Brook, New York, using the digitized Grant Microdensitometer interfaced with a computer.

This is a continuation of work previously supported by NSF grant AST76 04159.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0031, PHYSICAL NATURE OF COMETS

A.H. DELSEMME, Univ. of Toledo, School of Arts & Sciences, Physics & Astronomy, *2801 W. Bancroft St., Toledo, Ohio* 43606 (AST76-01776 A01)

Brightness profiles of different molecular, ionic and atomic emissions in comets will be obtained from spectra obtained either from ground-based observatories (in Toledo or elsewhere), or from space as far as the atomic resonance lines are concerned.

Coma models yielding quantitative production rates and molecular, ionic or atomic lifetimes against decay will then be deduced from the observed brightness profiles.

In order to elucidate the origin of comets, work will be undertaken using elemental solar abundances, to compute theoretically the chemical mixture for all temperature and pressure conditions that seem possible in the primeval solar nebula, and to find out whether a condensate of such a mixture could yield the observed molecules in their observed abundances.

Prior support was by NSF grant AST 76-07116.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0032, SOLUBILITIES OF C-O-S VOLATILES IN LUNAR MAGMAS AND VAPORS

D. EGGLER, Penn. State University, Graduate School, *205 Kern Graduate Bldg., University Park, Pennsylvania* 16802 (NSG 7465)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0033, PALEOFLOW PROCESSES AND FORMATION OF MARTIAN CHANNELS

J.C. BOOTHROYD, Univ. of Rhode Island, School of Arts & Sciences, Geology, *Woodward, Wakefield, Rhode Island* 02881 (NSG 7414)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0034, GROUND-BASED PHOTOMETRY OF HR 1099 COORDINATED WITH THE OCTOBER 1977 COPERNICUS CAMPAIGN

D.S. HALL, Vanderbilt University, School of Arts & Sciences, Physics, *21st Ave. S., Nashville, Tennessee* 37232 (NSG 7463)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0035, FUNDAMENTAL PROPERTIES OF NONTHERMAL EMISSION MECHANISMS IN RADIO SOURCES

J.J. BRODERICK, Virginia Poly. Inst. & St. U., School of Arts & Sciences, Physics, *Burruss Hall, Blacksburg, Virginia* 24061 (AST77-08013 A01)

The fundamental properties of nonthermal emission will be studied by radio astronomical techniques. The conditions required for the production of detectable nonthermal radio emission by stars, and the mechanisms by which it is produced, will be investigated by a series of complete radio surveys of 400 stars within 20 pc of the Sun. Sensitive surveys at 13 and 6 cm of several thousand galaxies brighter than mp equals 14.5 have been made and will be used to test current hypotheses relating radio structures and intensities to optical morphology, luminosities, and line spectra. Confusion-limited scans at 21 and 13 cm made in association with these surveys will be used to obtain statistical (P(D)) extragalactic source number counts and to detect possible anisotropy at the 1 mJy level. Very long baseline (VLB) interferometric observations of complete samples of extragalactic sources will be continued to isolate the effects of self-absorption and electron energy distributions on compact source spectra, and to relate source optical luminosity and morphology to radio core flux. Very long baseline pulsar data will be analyzed to yield unresolved calibration sources and information about the interstellar medium through a comparison of scattering sizes with dispersion measures. Interstellar scintillation observations will be made at low frequencies to find, or at least set strict limits on, possible high-brightness coherent emission mechanisms in extragalactic sources. The current research on optical identifications and spectroscopy of compact extragalactic sources will be continued. The nature of the hydrogen absorbing clouds in front of the quasi-stellar object 3C 286 and the BLLac object AO 0235 equals 164 will be investigated using spectral-line VLB techniques.

This is a continuation of work previously supported by NSF grant AST 77-08013.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0036, MARS SPECTRAL PHOTOMETRY AND SURFACE COMPOSITION

J.B. ADAMS, Univ. of Washington, School of Arts & Sciences, Geological Sciences, *C301 Health Sciences Bldg., Seattle, Washington* 98105 (NSG 7448)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

GENERAL

11.0001, INNOVATION PERFORMANCE WITHIN NASA-STIMULATED SEGMENT OF U.S. INDUSTRY - CONCEPTUAL FRAMEWORK & SOME PRELIMINARY EVIDENCE
N. ROSENBERG, Stanford University, School of Hum. & Sciences, Economics, *Palo Alto, California* 94305 (NCA 2-745815)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

11.0002, CASE STUDY, EVALUATION OF EFFECTIVENESS OF INFORMATION SERVICES RELATING TO THE PIONEER VENUS SPACE MISSION
D.E. BROWN, Calif. State Univ. & Colleges, School of Applied Sci. & Arts, Journalism & Advertising, *Washington Sq., San Jose, California* 95114 (NCA 2-675804)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

11.0003, DESIGN OF AN ADVANCED PACKET BROADCASTING SATELLITE SENSOR SYSTEM
N. ABRAMSON, Univ. of Hawaii, School of Engineering, Electrical Engin, *Bachman Hall, Honolulu, Hawaii* 96822 (NCA 2-285801)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

VOLUME 16 NUMBER 23 / DECEMBER 8, 1978

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N78-32036* + National Aeronautics and Space Administration, Washington, D. C.
AERONAUTICAL ENGINEERING: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 99
Aug. 1978 90 p refs
(NASA-SP-7037(99)) Avail: NTIS HC E02 CSCL 01A

This bibliography lists 292 reports, articles, and other documents introduced into the NASA scientific and technical information system in July 1978. Author

N78-32037*# FWG Associates, Inc., Tullahoma, Tenn.
INVESTIGATIONS OF SIMULATED AIRCRAFT FLIGHT THROUGH THUNDERSTORM OUTFLOWS
Walter Frost and Bill Crosby Sep. 1978 123 p refs
(Contract NAS8-32217)
(NASA-CR-3052; M-263) Avail: NTIS HC A06/MF A01 CSCL 01B

The effects of wind shear on aircraft flying through thunderstorm gust fronts were investigated. A computer program was developed to solve the two dimensional, nonlinear equations of aircraft motion, including wind shear. The procedure described and documented accounts for spatial and temporal variations of the aircraft within the flow regime. Analysis of flight paths and control inputs necessary to maintain specified trajectories for aircraft having characteristics of DC-8, B-747, augmentor wing STOL, and DHC-6 aircraft was recorded. From the analysis an attempt was made to find criteria for reduction of the hazards associated with landing through thunderstorm gust fronts. B.B.

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N78-32038 Iowa State Univ. of Science and Technology, Ames.
BLADE-SURFACE BOUNDARY LAYER AND WAKE COMPUTATIONAL MODELS FOR ESTIMATION OF AXIAL-FLOW COMPRESSOR AND FAN BLADE-ROW TURNING ANGLES AND LOSSES Ph.D. Thesis
Elmer Carl Hansen 1978 148 p
Avail: Univ. Microfilms Order No. 78-13230

A method is developed for computation of the flow field around an arbitrary blade cascade on an axially symmetric blade-to-blade surface, which takes into account the blade surface boundary layers, separation of the boundary layers and mixing in the wake. The method predicts the overall fluid turning and total pressure loss in the context of an inviscid-viscous interaction scheme. Dissert. Abstr.

N78-32039 Virginia Polytechnic Inst. and State Univ., Blacksburg.
A STUDY OF AXISYMMETRIC SEPARATION IN HIGH SPEED FLOWS Ph.D. Thesis
Michael Allen Kenworthy 1978 310 p
Avail: Univ. Microfilms Order No. 7814037

An unstable axisymmetric separation was conducted and studied using spiked cones in flows with free stream Mach numbers. Pressure measurements made on the model face using fast response instrumentation showed the pressure to exhibit a regular or periodic wave form. These wave forms were analyzed in terms of the time averaged frequency, f, and amplitude, delta p. These pressure measurements synchronized with spark photographs of the flow, two distinct modes of unstable axisymmetric flow were observed namely, oscillation and pulsation. These data were then examined with the purpose of establishing the mechanisms of the modes of unstable flow. An original hypothesis was developed for the oscillation mode based on a viscous mechanism. Comparison with experiment was made which showed this hypothesis to be a sound physical model. The pulsation mode was similarly treated revealing this mechanism to be of an inviscid nature. The results were used to predict the unstable flow parameters of an idealized ablation model of current practical interest. Dissert. Abstr.

N78-32040 Virginia Polytechnic Inst. and State Univ., Blacksburg.
THREE DIMENSIONAL FULLY VISCOUS SHOCK-LAYER FLOWS OVER SPHERE-CONES AT HIGH ALTITUDES AND ANGLES OF ATTACK Ph.D. Thesis
Alvin Lee Murray 1978 224 p
Avail: Univ. Microfilms Order No. 7814040

The viscous shock-layer equations were extended to complete 3-D flowfields and applied to sphere cones at high altitudes and large angles of attack. A computer code was developed for the solution of these equations and calculations were done on a large matrix of test cases. Comparisons with Stanton number, wall pressure and aerodynamic coefficient data show the predictions of the three-dimensional shock-layer code were in good to excellent agreement with experiments. Comparisons with solutions of the parabolized Navier-Stokes equations show the shock-layer calculations were in excellent agreement up to the cross-flow separation point. The Mach numbers for these test cases ranged from 10 to 25 and the Reynolds number ranged from 5.28 x 1,000 to 2.0 x 1,000,000 ft. The effects of slip were significant at the low Reynolds numbers but the small mass transfer rates that were tested had little effect.
Dissert. Abstr.

N78-32041 Purdue Univ., Lafayette, Ind.
THE FLOW FIELD CALCULATION IN SUPERSONIC MIXED-COMPRESSION AIRCRAFT INLETS AT ANGLE OF ATTACK USING THE THREE-DIMENSIONAL METHOD OF CHARACTERISTICS WITH DISCRETE SHOCK WAVE FITTING Ph.D. Thesis
Joseph Vadyak 1977 258 p
Avail: Univ. Microfilms Order No. 78-13132

The calculation of the flow field in supersonic mixed-compression aircraft inlets angle of attack is accomplished using the method of characteristics for steady three-dimensional flow

in conjunction with a discrete shock wave fitting procedure. The influence of molecular transport may be included in the computation by treating the viscous and thermal diffusion terms in the governing partial differential equations as correction terms in the method of characteristics scheme. The culmination of the research is the development of a production type computer program which is capable of calculating the flow field in a variety of axisymmetric mixed-compression aircraft inlets.
Dissert. Abstr.

N78-32042 California Univ., Berkeley.
ASYMMETRIC SUPERCRITICAL FLOW PAST A DOUBLE WEDGE WITH EMBEDDED SHOCKS Ph.D. Thesis
Keun Sick Chang 1977 78 p
Avail: Univ. Microfilms Order No. 7812516

Supercritical transonic flow past a double wedge at small angle of attack was analyzed in the hodograph plane. The flow is treated as steady, two-dimensional and inviscid, and is assumed to be isentropic and irrotational. Along the wedge surface the stagnation points are assumed to be attached at the forward and rear vertices and sonic speed is, a priori, attained at the upper and lower shoulders of the double wedge. The flow was mapped onto a hodograph plane containing two folds of a Riemann surface which are subsequently separated by a cut inserted along a branch line. In each of the two Riemann folds a numerical technique based on Telenin's method and a double sweep method was used to solve the two boundary value problems, one for the stream function and the other for the velocity potential.
Dissert. Abstr.

N78-32043*# National Aeronautics and Space Administration, Washington, D. C.
THE TECHNOLOGY ASSESSMENT OF LTA AIRCRAFT SYSTEMS
Sep. 1976 362 p refs Transl. into ENGLISH of "LTA Kokuki System on Technology Assessment", Rept. on Res. Commissioned in 1977 by the Technol. Evaluation Comm., Agency of Ind. Sci. and Technol., Japan Ind. Technol. Assoc., Mar. 1978 p 1-269, chapters 1-4 Trans. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Japan Ind. Technol. Assoc.
(Contract NASw-3199)
(NASA-TM-75535) Avail: NTIS HC A16/MF A01 CSCL 01A

The advantages of conventional small and large airships over heavier than air aircraft are reviewed and the need for developing hybrid aircraft for passenger and heavy charge transport is assessed. Performance requirements and estimated operating costs are discussed for rota-ships to be used for short distance transportation near large cities as well as for airlifting civil engineering machinery and supplies for the construction of power stations, dams, tunnels, and roads in remote areas or on isolated islands. A.R.H.

N78-32044*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HIGH ANGLE OF INCIDENCE IMPLICATIONS UPON AIR INTAKE DESIGN AND LOCATION FOR SUPERSONIC CRUISE AIRCRAFT AND HIGHLY MANEUVERABLE TRANSONIC AIRCRAFT
Leroy S. Presley Sep. 1978 13 p refs
(NASA-TM-78530; A-7634) Avail: NTIS HC A02/MF A01 CSCL 01A

Computational results which show the effects of angle of attack on supersonic mixed compression inlet performance at four different locations about a hypothetical forebody were obtained. These results demonstrate the power of the computational method to predict optimum inlet location, orientation, and centerbody control schedule for design and off design performance. The effects of inlet location and a forward canard on the angle-of-attack performance of a normal shock inlet at transonic speeds were studied. The data show that proper integration of inlet location and a forward canard can enhance the angle-of-attack performance of a normal shock inlet. Two lower lip treatments for improving the angle-of-attack performance of rectangular inlets at transonic speeds are discussed. Author

N78-32045*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SYMMETRICAL AND ASYMMETRICAL SEPARATIONS ABOUT A YAWED CONE
David J. Peake, F. Kevin Owen (Owen Intern., Inc., Palo Alto, Calif.), and Hiroshi Higuchi (Dyn. Technol., Inc.) Sep. 1978 30 p refs Sponsored in part by AFAL
(Contract NAS2-9663)
(NASA-TM-78532; A-7639) Avail: NTIS HC A03/MF A01 CSCL 01A

Three dimensional flow separations about a circular cone were investigated in the Mach number range 0.6 - 1.8. The cone was tested in the Ames 1.8 by 1.8 m wind tunnel at Reynolds numbers based on the cone length from 4,500,000 to 13,500,000 under nominally zero heat transfer conditions. Results indicate that: (1) the lee-side separated flow develops from initially symmetrically disposed and near-conical separation lines at angle of incidence/cone semiangle equal to approximately 1, with the free shear layers eventually rolling up into tightly coiled vortices at all Mach numbers; (2) the onset of asymmetry of the lee-side separated flow about the mean pitch plane is sensitive to Mach number, Reynolds number, and the nose bluntness; and (3) as the Mach number is increased beyond 1.8, the critical angle of incidence for the onset of asymmetry increases until at about M = 2.75 there is no longer any significant side force development. J.M.S.

N78-32046*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
COMPARISON OF WING-SPAN AVERAGING EFFECTS ON LIFT, ROLLING MOMENT, AND BENDING MOMENT FOR TWO SPAN LOAD DISTRIBUTIONS AND FOR TWO TURBULENCE REPRESENTATIONS
Jacob H. Lichtenstein Sep. 1978 49 p refs
(NASA-TM-78699; L-12014) Avail: NTIS HC A03/MF A01 CSCL 01A

An analytical method of computing the averaging effect of wing-span size on the loading of a wing induced by random turbulence was adapted for use on a digital electronic computer. The turbulence input was assumed to have a Dryden power spectral density. The computations were made for lift, rolling moment, and bending moment for two span load distributions, rectangular and elliptic. Data are presented to show the wing-span averaging effect for wing-span ratios encompassing current airplane sizes. The rectangular wing-span loading showed a slightly greater averaging effect than did the elliptic loading. In the frequency range most bothersome to airplane passengers, the wing-span averaging effect can reduce the normal lift load, and thus the acceleration, by about 7 percent for a typical medium-sized transport. Some calculations were made to evaluate the effect of using a Von Karman turbulence representation. These results showed that using the Von Karman representation generally resulted in a span averaging effect about 3 percent larger.
Author

N78-32047*# Vought Corp., Hampton, Va. Hampton Technical Center.
BOEING-747 AIRCRAFT WITH EXTERNAL CARGO POD
C. B. Quartero, G. F. Washburn, and J. E. Price Jul. 1978 25 p refs
(Contract NAS1-13500)
(NASA-CR-158932) Avail: NTIS HC A02/MF A01 CSCL 01A

An analysis was conducted to investigate the feasibility of mounting a detachable pod to the underside of the fuselage of a Boeing Model 747 aircraft to carry outsized cargo in case of military emergency. The analysis showed that the 747 configured with the pod and carrying only a bridge launcher as payload attained a range of 8.70 Mm (4 700 n. mi.) at Mach 68. This range was based on a maximum take-off gross weight of 3.447 MN (775 000 lbf) which included 212 kN (47 700 lbf) pod weight and 543 kN (122 000 lbf) payload (bridge launcher). B.B.

N78-32048*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
WIND TUNNEL TESTS ON A TAIL-LESS SWEPT WING SPAN-DISTRIBUTED CARGO AIRCRAFT CONFIGURATION
Dhanvada M. Rao (Old Dominion Univ. Research Foundation) and Jarrett K. Huffman Sep. 1978 140 p refs

(NASA-TM-78767) Avail: NTIS HC A07/MF A01 CSCL 01A

The configuration consisted of a 30 deg -swept, untapered, untwisted wing utilizing a low-moment cambered airfoil of 20 percent streamwise thickness designed for low wave drag at M = 0.6, C sub L = 0.4. The tests covered a range of Mach numbers 0.3 to 0.725 and chord Reynolds number 1,100,000 to 2,040,000, angles of attack up to model buffet and sideslip angles + or - 4 deg. Configuration build up, wing pod filleting, airfoil modification and trailing edge control deflection effects were briefly investigated. Three wing tip vertical tail designs were also tested. Wing body filleting and a simple airfoil modification both produced increments to maximum lift/drag ratio. Addition of pods eliminated pitch instability of the basic wing. While the magnitude of these benefits probably was Reynolds number sensitive, they underline the potential for improving the aerodynamics of the present configuration. The cruise parameter (product of Mach number and lift/drag ratio) attained a maximum close to the airfoil design point. The configuration was found to be positively stable with normal control effectiveness about all three axes in the Mach number and C sub L range of interest. Author

N78-32049*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

AERODYNAMIC CHARACTERISTICS OF A 1/4 SCALE POWERED HELICOPTER MODEL WITH A V-TYPE EMPENNAGE

Carl E. Freeman, Arthur E. Phelps, III, and Raymond E. Mineck Aug. 1978 65 p refs

(NASA-TM-74033) Avail: NTIS HC A04/MF A01 CSCL 01A

An investigation was made in the Langley V/STOL tunnel to determine rotor induced effects on a 1/4-scale helicopter model with a conventional empennage and also a V-type empennage with dihedral angles of 45 deg, 50 deg, 55 deg, and 60 deg. Static longitudinal and lateral directional stability data are presented for rotor advance ratios of 0.057, 0.102, and 0.192 in level flight and climb attitudes. The data are presented without analysis or discussion. Author

N78-32050*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

AERODYNAMIC CHARACTERISTICS OF A FIXED ARROW-WING SUPERSONIC CRUISE AIRCRAFT AT MACH NUMBERS OF 2.30, 2.70, AND 2.95

Odell A. Morris, Dennis E. Fuller, and Carolyn B. Watson Aug. 1978 199 p

(NASA-TM-78706; L-12249) Avail: NTIS HC A09/MF A01 CSCL 01A

Tests were conducted in the Langley Unitary Plan wind tunnel at Mach numbers of 2.30, 2.70, and 2.95 to determine the performance, static stability, and control characteristics of a model of a fixed-wing supersonic cruise aircraft with a design Mach Number of 2.70 (SCAT 15-F-9898). The configuration had a 74 deg swept warped wing with a reflexed trailing edge and four engine nacelles mounted below the reflexed portion of the wing. A number of variations in the basic configuration were investigated; they included the effect of wing leading edge radius, the effect of various model components, and the effect of model control deflections. Author

N78-32051*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

DEVELOPMENT OF A NONLINEAR SWITCHING FUNCTION AND ITS APPLICATION TO STATIC LIFT CHARACTERISTICS OF STRAIGHT WINGS

Donald E. Hewes Sep. 1978 44 p refs

(NASA-TM-78737; L-12270) Avail: NTIS HC A03/MF A01 CSCL 01A

A mathematical modeling technique was developed for the lift characteristics of straight wings throughout a very wide angle of attack range. The technique employs a mathematical switching function that facilitates the representation of the nonlinear aerodynamic characteristics in the partially and fully stalled regions and permits matching empirical data within + or - 4 percent of maximum values. Although specifically developed for use in modeling the lift characteristics, the technique appears to have other applications in both aerodynamic and nonaerodynamic fields. B.B.

N78-32052*# National Aeronautics and Space Administration, Washington, D. C.

DESIGN OF A TRANSONICALLY PROFILED WING

B. Kiekebusch Aug. 1978 82 p refs Transl. into ENGLISH of conf. paper from Messerschmitt-Boelkow-Blohm G.m.b.H., Hamburg, Paper-77-026 77 p Presented at the 10th Jahrestagung, Deutsche Ges fuer Luft- und Raumfahrt, Berlin, 13-15 Sep. 1977 Original language document was announced as A78-24417 Transl. by SCITRAN, Santa Barbara, Calif.

(Contract NASw-3198)

(NASA-TM-75440; Paper-77-026) Avail: NTIS HC A04/MF A01 CSCL 01A

The application of well known design concepts with the combined use of thick transonic profiles to aircraft wing design was investigated. Optimization in terms of weight and operational costs was emphasized. It is shown that the usual design criteria and concepts are too restricted and do not sufficiently represent the physical processes over the wing. Suggestions are made for improving this situation, and a design example given. Compared with a wing design according to previously used criteria, the new design is found to be superior in the most important functions. It is concluded that an isobar concept adjusted to the planform in conjunction with an 'organically' designed wing will lead to the weight optimum solutions of wing profiles. J.M.S.

N78-32053*# National Aeronautics and Space Administration, Washington, D. C.

PRACTICAL CALCULATION OF LAMINAR AND TURBULENT BLED-OFF BOUNDARY LAYERS

R. Eppler Sep. 1978 59 p refs Transl. into ENGLISH from Ing.-Arch. (Germany), v. 32, no. 4, 1963 p 221-245 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Bolkow-entwicklungen KG, West Germany

(Contract NASw-3199)

(NASA-TM-75328) Avail: NTIS HC A04/MF A01 CSCL 01A

Bleed-off of boundary layer material is shown to be an effective means for reducing drag by conserving the laminar boundary layer and preventing separation of the turbulent boundary layer. The case in which the two effects of bleed-off overlap is examined. Empirical methods are extended to the case of bleed-off. Laminar and turbulent boundary layers are treated simultaneously and the approximation differential equations are solved without an uncertain error. The case without bleed-off is also treated.J.M.S.

N78-32054*# National Aeronautics and Space Administration, Washington, D. C.

PROFILE DESIGN FOR AN ADVANCED-TECHNOLOGY AIRFOIL FOR GENERAL AVIATION AIRCRAFT

D. Welte Aug. 1978 24 p refs Transl. into ENGLISH of "Profilentwurf fuer einen Tragflugel neuer Technologie fuer Flugzeuge der allgemeinen Luftfahrt", Paper-77-027 Deutsche Gesellschaft fuer Luft- und Raumfahrt, Berlin, 13-15 Sep. 1977 25 p Original language document was announced as A78-24418 Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(Contract NASw-3199)

(NASA-TM-75323; Paper-77-027) Avail: NTIS HC A02/MF A01 CSCL 01A

A profile from the NASA General Aviation Whitcomb series and NACA profiles are used as a starting point in designing an advanced airfoil for general aviation aircraft. Potential theory pressure distribution calculations, together with boundary layer calculations, permit a decrease in the null moment and an optimization of the lift characteristics of the wing. Trailing edge flap design is also improved. Wind tunnel tests are used to compare the conventional profiles, the NASA profile, and the improved design. Author

N78-32055*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

YF-12 EXPERIMENTS SYMPOSIUM, VOLUME 1

Aug. 1978 286 p refs Symp. held at Edwards, Calif., 13-15 Sep. 1978 Prepared by James and Associates, Lancaster, Calif.

(NASA-CP-2054; H-1059) Avail: NTIS HC A13/MF A01 CSCL 01A

Papers presented by personnel from the Dryden Flight Research Center, the Lewis Research Center, and the Ames Research Center are presented. Topics cover propulsion system

performance, inlet time varying distortion, structures, aircraft controls, propulsion controls, and aerodynamics. The reports were based on analytical studies, laboratory experiments, wind tunnel tests, and extensive flight research with two YF-12 airplanes. For individual titles, see N78-32056 through N78-32065.

N78-32056*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

OVERVIEW OF THE NASA YF-12 PROGRAM

Berwin M. Kock *In its* YF-12 Experiments Symp., Vol. 1 Aug. 1978 p 3-25 refs (For primary document see N78-32055 23-02)

Avail: NTIS HC A13/MF A01 CSCL 01C

The history of NASA's interest in supersonic research and the agency's contribution to the development of the YF 12 aircraft is reviewed as well as the program designed to use that aircraft as a test bed for supersonic cruise research. Topics cover elements of the program, project organization, and major accomplishments. A.R.H.

N78-32057*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

RECENT LOAD CALIBRATIONS EXPERIENCE WITH THE YF-12 AIRPLANE

Jerald M. Jenkins and Albert E. Kuhl *In its* YF-12 Experiments Symp., Vol. 1 Aug. 1978 p 47-72 refs (For primary document see N78-32055 23-02)

Avail: NTIS HC A13/MF A01 CSCL 01A

The use of calibrated strain gages to measure wing loads on the YF-12A airplane is discussed as well as structural configurations relative to the thermal environment and resulting thermal stresses. A thermal calibration of the YF-12A is described to illustrate how contaminating thermal effects can be removed from loads equations. The relationship between ground load calibrations and flight measurements is examined for possible errors, and an analytical approach to accommodate such errors is presented. A.R.H.

N78-32058*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

FLIGHT-MEASURED AERODYNAMIC LOADS ON A 0.92 ASPECT RATIO LIFTING SURFACE

Robert R. Meyer, Jr. and V. Michael DeAngelis *In its* YF-12 Experiments Symp., Vol. 1 Aug. 1978 p 73-91 refs (For primary document see N78-32055 23-02)

Avail: NTIS HC A13/MF A01 CSCL 01A

Ventral fin loads, expressed as normal force coefficients, bending moment coefficients, and torque coefficients, were measured during flight tests of a YF-12A airplane. Because of the proximity of the ventral fin to the ailerons, the aerodynamic loads presented were the result of both sideslip loads and aileron crossflow loads. Aerodynamic data obtained from strain gage loads instrumentation and some flight pressure measurements are presented for several Mach numbers ranging from 0.70 to 2.00. Selected wind tunnel data and results of linear theoretical aerodynamic calculations are presented for comparison. Author

N78-32059*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

FLIGHT EXPERIENCE WITH ALTITUDE HOLD AND MACH HOLD AUTOPILOTS ON THE YF-12 AIRCRAFT AT MACH 3

Glenn B. Gilyard and John W. Smith *In its* YF-12 Experiments Symp., Vol. 1 Aug. 1978 p 97-119 refs (For primary document see N78-32055 23-02)

Avail: NTIS HC A13/MF A01 CSCL 01A

The altitude hold mode of the YF-12A airplane was modified to include a high-pass-filtered pitch rate feedback along with optimized inner loop altitude rate proportional and integral gains. An autothrottle control system was also developed to control either Mach number or KEAS at the high-speed flight conditions. Flight tests indicate that, with the modified system, significant improvements are obtained in both altitude and speed control, and the combination of altitude and autothrottle hold modes provides the most stable aircraft platform thus far demonstrated at Mach 3 conditions. A.R.H.

N78-32060*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

PILOT WORKLOAD MEASUREMENT AND EXPERIENCE ON SUPERSONIC CRUISE AIRCRAFT

Terrence W. Rezek *In its* YF-12 Experiments Symp., Vol. 1 Aug. 1978 p 121-134 refs (For primary document see N78-32055 23-02)

Avail: NTIS HC A13/MF A01 CSCL 05H

Aircraft parameters and physiological parameters most indicative of crew workload were investigated. Recommendations were used to form the basis for a continuing study in which variations of the interval between heart beats are used as a measure of nonphysical workload. Preliminary results are presented and current efforts in further defining this physiological measure are outlined. A.R.H.

N78-32061*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

THE YF-12 GUST VELOCITY MEASURING SYSTEM

J. Ehernberger *In its* YF-12 Experiments Symp., Vol. 1 Aug. 1978 p 135-154 refs (For primary document see N78-32055 23-02)

Avail: NTIS HC A13/MF A01 CSCL 01D

A true gust velocity measuring system designed to alleviate complications resulting from airframe flexibility and from the high-speed, high-temperature environment of supersonic cruise aircraft was evaluated on a YF-12 airplane. The system uses fixed vanes on which airflow direction changes produce differential pressure variations that are measured. Airframe motions, obtained by postflight integration of recorded angular rate and linear acceleration data, are removed from the flow angle data. An example of turbulence data obtained at high-altitude, supersonic flight conditions is presented and compared with previous high-altitude turbulence measurements obtained with subsonic aircraft and with turbulence criteria contained in both military and civil design specifications for supersonic cruise vehicles. Results of these comparisons indicate that the YF-12 turbulence sample is representative of turbulence present in the supersonic cruise environment. A.R.H.

N78-32062*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

WIND TUNNEL EVALUATION OF YF-12 INLET RESPONSE TO INTERNAL AIRFLOW DISTURBANCES WITH AND WITHOUT CONTROL

Gary L. Cole, George H. Neiner, and Miles O. Dustin *In* NASA. Dryden Flight Res. Center YF-12 Experiments Symp., Vol. 1 Aug. 1978 p 157-192 refs (For primary document see N78-32055 23-02)

Avail: NTIS HC A13/MF A01 CSCL 01A

The response of terminal-shock position and static pressures in the subsonic duct of a YF-12 aircraft flight-hardware inlet to perturbations in simulated engine corrected airflow were obtained with and without inlet control. Frequency response data, obtained with inlet controls inactive, indicated the general nature of the inherent inlet dynamics, assisted in the design of controls, and provided a baseline reference for responses with active controls. All the control laws were implemented by means of a digital computer that could be programmed to behave like the flight inlet's existing analog control. The experimental controls were designed using an analytical optimization technique. The capabilities of the controls were limited primarily by the actuation hardware. The experimental controls provided somewhat better attenuation of terminal shock excursions than did the YF-13 inlet control. Controls using both the forward and aft bypass systems also provided somewhat better attenuation than those using just the forward bypass. The main advantage of using both bypasses is in the greater control flexibility that is achieved. A.R.H.

N78-32063*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

FLIGHT-MEASURED PRESSURE CHARACTERISTICS OF AFT-FACING STEPS IN THICK BOUNDARY LAYER FLOW FOR TRANSONIC AND SUPERSONIC MACH NUMBERS

Sheryll Goecke Powers *In its* YF-12 Experiments Symp., Vol. 1 Aug. 1978 p 201-226 refs (For primary document see N78-32055 23-02)

Avail: NTIS HC A13/MF A01 CSCL 01A

Aft-facing step base pressure flight data were obtained for three step heights for nominal transonic Mach numbers of 0.80, 0.90, and 0.95, and for supersonic Mach numbers of 2.2, 2.5, and 2.8 with a Reynolds number, based on the fuselage length ahead of the step, of about 10 to the 8th power. Surface static pressures were measured ahead of the step, behind the step, and on the step face (base), and a boundary layer rake was used to obtain boundary layer reference conditions. A comparison of the data from the present and previous experiments shows the same trend of increasing base pressure ratio (decreasing drag) with increasing values of momentum thickness to step height ratios. However, the absolute level of these data does not always agree at the supersonic Mach numbers. For momentum thickness to height ratios near 1.0, the differences in the base pressure ratios appear to be primarily a function of Reynolds number based on the momentum thickness. Thus, for Mach numbers above 2, the data analyzed show that the base pressure ratio decreases (drag increases) as Reynolds number based on momentum thickness increases for a given momentum thickness and step height. A.R.H.

N78-32064*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

BOUNDARY LAYER, SKIN FRICTION, AND BOATTAIL PRESSURE MEASUREMENTS FROM THE YF-12 AIRPLANE AT MACH NUMBERS UP TO 3

David F. Fisher *In its* YF-12 Experiments Symp., Vol. 1 Aug. 1978 p 227-258 refs (For primary document see N78-32055 23-02)

Avail: NTIS HC A13/MF A01 CSCL 01A

In-flight measurements of boundary layer and skin friction data were made on YF-12 airplanes for Mach numbers between 2.0 and 3.0. Boattail pressures were also obtained for Mach numbers between 0.7 and 3.0 with Reynolds numbers up to four hundred million. Boundary layer data measured along the lower fuselage centerline indicate local displacement and momentum thicknesses can be much larger than predicted. Skin friction coefficients measured at two of five lower fuselage stations were significantly less than predicted by flat plate theory. The presence of large differences between measured boattail pressure drag and values calculated by a potential flow solution indicates the presence of vortex effects on the upper boattail surface. At both subsonic and supersonic speeds, pressure drag on the longer of two boattail configurations was equal to or less than the pressure drag on the shorter configuration. At subsonic and transonic speeds, the difference in the drag coefficient was on the order of 0.0008 to 0.0010. In the supersonic cruise range, the difference in the drag coefficient was on the order of 0.002. Boattail drag coefficients are based on wing reference area. A.R.H.

N78-32065*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

IN-FLIGHT COMPRESSIBLE TURBULENT BOUNDARY LAYER MEASUREMENTS ON A HOLLOW CYLINDER AT A MACH NUMBER OF 3.0

Robert D. Quinn and Leslie Gong *In its* YF-12 Experiments Symp., Vol. 1 Aug. 1978 p 259-286 refs (For primary document see N78-32055 23-02)

Avail: NTIS HC A13/MF A01 CSCL 01A

Skin temperatures, shearing forces, surface static pressures, and boundary layer pitot pressures and total temperatures were measured on a hollow cylinder 3.04 meters long and 0.437 meter in diameter mounted beneath the fuselage of the YF-12A airplane. The data were obtained at a nominal free stream Mach number of 3.0 and at wall-to-recovery temperature ratios of 0.66 to 0.91. The free stream Reynolds number had a minimal value of 4.2 million per meter. Heat transfer coefficients and skin friction coefficients were derived from skin temperature time histories and shear force measurements, respectively. Boundary layer velocity profiles were derived from pitot pressure measurements, and a Reynolds analogy factor of 1.11 was obtained from the measured heat transfer and skin friction data. The skin friction coefficients predicted by the theory of van Driest were in excellent agreement with the measurements. Theoretical heat transfer coefficients, in the form of Stanton numbers calculated by using a modified Reynolds analogy between skin friction and heat transfer, were compared with measured values. The measured velocity profiles were compared to Coles' incompressible law-of-the-wall profile. A.R.H.

N78-32066*# Hamilton Standard, Windsor Locks, Conn.

AERODYNAMIC DESIGN AND PERFORMANCE TESTING OF AN ADVANCED 30 DEG SWEPT, EIGHT BLADED PROPELLER AT MACH NUMBERS FROM 0.2 TO 0.85 Final Report

D. M. Black, R. W. Menthe, and H. S. Wainauski Sep. 1978 119 p refs

(Contract NAS3-20219)

(NASA-CR-3047) Avail: NTIS HC A06/MF A01 CSCL 01A

The increased emphasis on fuel conservation in the world has stimulated a series of studies of both conventional and unconventional propulsion systems for commercial aircraft. Preliminary results from these studies indicate that a fuel saving of from 15 to 28 percent may be realized by the use of an advanced high speed turboprop. The turboprop must be capable of high efficiency at Mach 0.8 above 10.68 km (35,000 ft) altitude if it is to compete with turbofan powered commercial aircraft. An advanced turboprop concept was wind tunnel tested. The model included such concepts as an aerodynamically integrated propeller/nacelle, blade sweep and power (disk) loadings approximately three times higher than conventional propeller designs. The aerodynamic design for the model is discussed. Test results are presented which indicate propeller net efficiencies near 80 percent were obtained at high disk loadings at Mach 0.8. B.B.

N78-32067*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

WIND-TUNNEL INVESTIGATION AT SUPERSONIC SPEEDS OF A CANARD-CONTROLLED MISSILE WITH FIXED AND FREE-ROLLING TAIL FINS

A. B. Blair, Jr. Sep. 1978 79 p refs

(NASA-TP-1316; L-12297) Avail: NTIS HC A05/MF A01 CSCL 01A

A wind tunnel investigation was made at free stream Mach numbers from 1.70 to 2.86 to determine the effects of fixed and free rolling tail fin afterbodies on the static longitudinal and lateral aerodynamic characteristics of a cruciform canard controlled missile model. The effect of small canard roll and yaw control deflections was also examined. The results indicate that the fixed and free rolling tail configurations have about the same lift curve slope and longitudinal stability level at low angles of attack. For the free rolling tail configuration, the canards provide conventional roll control with no roll control reversal at low angles of attack. The free rolling tail configuration reduced induced roll due to model roll angle and canard yaw control. B.B.

N78-32068# ARO, Inc., Arnold Air Force Station, Tenn.

INFLUENCES OF SWAY BRACES AND MOUNTING GAPS ON THE STATIC AERODYNAMIC LOADING OF EXTERNAL STORES Final Report, 1 Oct. 1976 - 30 Sep. 1977

R. E. Dix AEDC Feb. 1978 135 p refs

(AD-A054963; AEDC-TR-77-117) Avail: NTIS HC A07/MF A01 CSCL 01/3

As the scale factor applied in the design of wind tunnel models is reduced, many details of the configuration being simulated are customarily omitted. A series of experiments was conducted in the Aerodynamic Wind Tunnel (4T) of the Propulsion Wind Tunnel Facility at the Arnold Engineering Development Center to evaluate the effect on captive store loading of model details such as sway braces and mounting gaps existing between store and aircraft components. Six components of aerodynamic loads acting on both pylon and rack-mounted stores in the captive position were measured, a limited number of store separation trajectories was predicted using the captive trajectory system, and a brief comparison of wind tunnel and in-flight measurements of captive loads was made. It was determined that the effects of mounting gaps or flow ventilation passages were generally small, but that sway braces can significantly influence both captive loads and separation trajectories. It was also observed that better agreement between wind tunnel and in-flight measurements of captive store loading resulted when mounting gaps and sway braces were simulated on the wind-tunnel models. Author (GRA)

N78-32069# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
V/STOL AERODYNAMIC TECHNOLOGY ASSESSMENT Interim Report
C. Henderson and M. Walters 15 May 1978 91 p refs (WF41400000)
(AD-A054797; NADC-77272-60) Avail: NTIS HC A05/MF A01 CSCL 20/4

The objective of this investigation is to determine the status of V/STOL aerodynamics technology; evaluating the capabilities and limitations of various techniques and the validity of methods through correlations of predictions with wind tunnel and/or flight test results. This interim report presents the results of the first phase of this effort; a survey and assessment of published methods and test results and a survey of industry applied methods and technology problem areas. Author (GRA)

N78-32070# Aerospace Systems, Inc., Burlington, Mass.
ROTOR WAKE EFFECTS ON HUB/PYLON FLOW. VOLUME 1: THEORETICAL FORMULATION Final Report, Jun. 1975 - Sep. 1977
Paul Soohoo, Richard B. Noll, Luigi Morino, and Norman D. Hamm May 1978 120 p refs
(Contract DAAJ02-75-C-0041)
(AD-A055921; ASI-TR-76-38-Vol-1; USARTL-TR-78-1A-Vol-1) Avail: NTIS HC A06/MF A01 CSCL 20/4

An investigation has been conducted to demonstrate the use of the Green's function method to study rotor wake effects on helicopter hub/pylon flow. This report consists of two volumes which document the theoretical formulation and the use of the digital computer program SHAPES (Subsonic Helicopter Aerodynamics Program with Effects of Separaton). Volume 1 presents the theoretical formulation and corresponding numerical procedure for the study of incompressible potential aerodynamics with separated flow. While the formulation is valid for fully unsteady aerodynamics, this report is mainly concerned with rotor aerodynamics. A potential flow aerodynamic program, SHAPES, with suitable rotor wake representation was developed to predict the separation characteristics of arbitrary three-dimensional helicopter configurations. In particular, the effect of the rotor blade wake, blade shank wake, and hub wake in the separation of the flow over a lifting helicopter in forward flight is analyzed. The present method has potential application in the design of helicopters because it provides an analytical capability which can be used to develop low-drag profile as well as to explore problem areas. Extensive numerical results obtained from Program SHAPES demonstrated the flexibility and accuracy of the method. These results are in excellent agreement with existing data. Author (GRA)

N78-32071# Aerospace Systems, Inc., Burlington, Mass.
ROTOR WAKE EFFECTS ON HUB/PYLON FLOW. VOLUME 2: PROGRAM SHAPES USER'S MANUAL Final Report, Jun. 1975 - Sep. 1977
Paul Soohoo, Richard B. Noll, Luigi Morino, and Norman D. Hamm May 1978 192 p refs
(Contract DAAJ02-75-C-0041)
(AD-A055767; ASI-TR-76-38-Vol-2; USARTL-TR-78-1B-Vol-2) Avail: NTIS HC A09/MF A01 CSCL 20/4

An investigation has been conducted to demonstrate the use of the Green's function method to study rotor wake effects on helicopter hub/pylon flow. This report consists of two volumes which document the theoretical formulation and the use of the digital computer program SHAPES (Subsonic Helicopter Aerodynamics Program with Effects of Separation). Volume 2, The User's Manual, describes the structure and use of Program SHAPES. SHAPES is written in FORTRAN 4 for operation on the CDC 6600 digital computer system at the Applied Technology Laboratory, U.S. Army Research and Technology Laboratories Fort Eustis, VA. The User's Manual (Volume (2) contains detailed information for preparing an input data deck and interpreting the computed data; a discussion of various subroutines, flow charts, common storage and definition of FORTRAN variables; sample cases to illustrate the program output; and a FORTRAN listing of the program. GRA

N78-32072# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
M=3 TURBULENT BOUNDARY LAYER MEASUREMENTS AT VERY HIGH REYNOLDS NUMBERS Interim Report, Jan. 1975 - Sep. 1976
Anthony W. Fiore Oct. 1977 230 p refs
(AD-A055952; AFFDL-TR-77-80) Avail: NTIS HC A11/MF A01 CSCL 20/4

Experimental turbulent boundary layer measurements were made. Data was generated at supersonic speeds and very high Reynolds numbers to determine the effect of both unit and length Reynolds numbers on boundary layer profiles, thickness parameters, and skin friction measurements. GRA

N78-32073# National Technical Information Service, Springfield, Va.
LIGHTER THAN AIR VEHICLES. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Mar. 1978
Guy E. Habercom, Jr. May 1978 82 p Supersedes NTIS/PS-77/0375
(NTIS/PS-78/0410/7; NTIS/PS-77/0375) Avail: NTIS HC $28.00/MF $28.00 CSCL 01C

Design and applications of balloons, dirigibles, and airships are investigated in these reports gathered in a worldwide literature survey. Passenger or cargo transport, timbering, tethering, and fabric selection are among the aspects investigated. GRA

N78-32074# Advisory Group for Aerospace Research and Development, Paris (France).
TECHNICAL EVALUATION REPORT ON THE FLUID DYNAMICS PANEL SYMPOSIUM ON PREDICTION OF AERODYNAMIC LOADING
Rimantas Liaugminas (Dept. of AF, Wright-Patterson AFB, Ohio) Sep. 1978 18 p refs Symp. held at Moffett Field, Calif., 27-29 Sep. 1976
(AGARD-AR-125; ISBN-92-835-1296-0) Avail: NTIS HC A02/MF A01

The fluid dynamic aspects of predicting aerodynamic loads that represent difficult design and operating problems are examined with emphasis on theoretical and semi-empirical methods for determining the level and distribution of the expected loading and on assessing and evaluating the accuracy of the predicted values through comparison with available experimental data from windtunnels and flight tests. Advances in the state-of-art of aerodynamic load prediction are summarized and problem areas for further research effort are indicated. Topics cover: test techniques; stores; high angle of attack; high lift and drag; viscous/inviscid interactions in transonic flow; maneuvering aircraft; unsteady loads on arbitrary bodies in supersonic flow; flow with separation; dynamic stall; buffeting; and special problem areas. A.R.H.

N78-32124# Indian Inst. of Science, Bangalore. Dept. of Aeronautical Engineering.
HYPERSONIC FLOWS
N. M. Reddy *In its* Space Sci., Technol. and Appl.: An Overview Apr. 1978 7 p refs (For primary document see N78-32114 23-12)
Avail: NTIS HC A10/MF A01

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N78-32075*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NASA AVIATION SAFETY REPORTING SYSTEM Quarterly Report, 1 Jul. - 30 Sep. 1977
Jul. 1978 62 p refs Prepared in cooperation with Battelle Columbus Labs., Mountain View, Calif.
(NASA-TM-78511; A-7559; QR-6) Avail: NTIS HC A04/MF A01 CSCL 01C

An analytical study of reports relating to cockpit altitude alert systems was performed. A recent change in the Federal Air Regulation permits the system to be modified so that the alerting signal approaching altitude has only a visual component; the auditory signal would continue to be heard if a deviation from an assigned altitude occurred. Failure to observe altitude alert signals and failure to reset the system were the commonest cause of altitude deviations related to this system. Cockpit crew distraction was the most frequent reason for these failures. It was noted by numerous reporters that the presence of altitude alert system made them less aware of altitude; this lack of altitude awareness is discussed. Failures of crew coordination were also noted. It is suggested that although modification of the altitude alert system may be highly desirable in short-haul aircraft, it may not be desirable for long-haul aircraft in which cockpit workloads are much lower for long periods of time. In these cockpits, the aural alert approaching altitudes is perceived as useful and helpful. If the systems are to be modified, it appears that additional emphasis on altitude awareness during recurrent training will be necessary; it is also possible that flight crew operating procedures during climb and descent may need examination with respect to monitoring responsibilities. A selection of alert bulletins and responses to them is presented. B.B.

N78-32076*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

A PRELIMINARY STUDY OF THE BENEFITS OF FLYING BY GROUND SPEED DURING FINAL APPROACH

Earl C. Hastings, Jr. Aug. 1978 23 p refs

(NASA-TM-78777) Avail: NTIS HC A02/MF A01 CSCL 01C

A study was conducted to evaluate the benefits of an approach technique which utilized constant ground speed on approach. It was determined that the technique reduced the capacity losses in headwinds experienced with the currently used constant airspeed technique. The benefits of technique were found to increase as headwinds increased and as the wake avoidance separation intervals were reduced. An additional benefit noted for the constant ground speed technique was a reduction in stopping distance variance due to the approach wind environment. B.B.

N78-32077# Army Research and Technology Labs., Fort Eustis, Va.

CH-47 CRASH TEST (T-40) STRUCTURAL, CARGO RESTRAINT, AND AIR CREW INFLATABLE RESTRAINT EXPERIMENTS

L. Burrows, R. Lane, and J. McElhenney Apr. 1978 111 p refs

(AD-A055804; USARTL-TR-78-22) Avail: NTIS HC A06/MF A01 CSCL 01/3

A full-scale crash test of a CH-47A troop/cargo helicopter was conducted at the NASA-Langley Research Center Impact Dynamics Research Facility. This joint Army/NASA/Navy test program was performed as part of the Army's continuing research and development program to enhance the crashworthiness of helicopters. This report describes the structural crashworthiness, the load attenuating cargo restraint, and the aircrew inflatable crew restraint experiments that were conducted, and presents the resulting data. The test aircraft crashed with a 9 degree nose-down attitude; this impact was representative of the 95th percentile potentially survivable accident crash pulse. Results of the test can be compared with those of a CH-47C crash test (T-39) conducted in 1975, which impacted at a 10 degree nose-up attitude with approximately the same resultant impact velocity vector. Author (GRA)

N78-32078# Sandia Labs., Albuquerque, N. Mex.

ANALYSIS OF THE ENGINE FRAGMENT THREAT AND THE CRUSH ENVIRONMENT FOR SMALL PACKAGES CARRIED ON US COMMERCIAL JET AIRCRAFT

W. F. Hartman, J. D. McClure, and W. A. VonRiesemann 1978 8 p refs Presented at the 5th Symp. on the Packaging and Transportation of Radioactive Mater., Las Vegas, Nev., 7 May 1978

(Contract EY-76-C-04-0789)

(SAND-78-0244C; CONF-780506-8) Avail: NTIS HC A02/MF A01

The results of two separate analyses are reported. The engine fragment analysis determined the probability of a small package being in the path of a fragment from a failure in a gas turbine engine. The calculated values show that, depending on aircraft type, the incidence rate varies by approximately an order of magnitude from a high of about once per 5 million flights to a low of nearly once every 40 million package flights for a flight of five hours' duration. The analysis of the crush environment consisted of an examination of two principal crush modes, i.e., vertical and longitudinal crush. The vertical crush mode was examined by formulating a structural model of the cargo deck beams of the aircraft. The longitudinal crush mode was studied by using dynamic models of the aircraft cargo and the radioactive material package (RAM). ERA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N78-32079*# Litton Systems, Inc., Woodland Hills, Calif.

STRAPDOWN SYSTEM REDUNDANCY MANAGEMENT FLIGHT DEMONSTRATION Final Report

Sep. 1978 73 p refs

(Contract NAS1-15155)

(NASA-CR-145356) Avail: NTIS HC A04/MF A01 CSCL 17G

The suitability of strapdown inertial systems in providing highly reliable short-term navigation for vertical take-off and landing (VTOL) aircraft operating in an intra-urban setting under all-weather conditions was assessed. A preliminary design configuration of a skewed sensor inertial reference system employing a redundancy management concept to achieve fail-operational, fail-operational performance, was developed. A.R.H.

N78-32080*# Virginia Univ., Charlottesville. School of Engineering and Applied Science.

OPTIMIZATION OF MLS RECEIVERS FOR MULTIPATH ENVIRONMENTS Annual Report

G. A. McAlpine, J. H. Highfill, III, C. P. J. Tzeng, and Ghassem Koleyni Oct. 1978 62 p refs

(Grant NsG-1128)

(NASA-CR-157736; UVA/528062/EE78/106) Avail: NTIS HC A04/MF A01 CSCL 17G

Reduced order receiver (suboptimal receiver) analysis in multipath environments is presented. The origin and objective of MLS is described briefly. Signal modeling in MLS the optimum receiver is also included and a description of a computer oriented technique which was used in the simulation study of the suboptimal receiver is provided. Results and conclusion obtained from the research for the suboptimal receiver are reported. B.B.

N78-32081# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

STATE NOISE COVARIANCE IN THE KALMAN FILTER M.S. Thesis

David Arthur Arpin Dec. 1977 151 p refs

(AD-A055686; AFIT/GE/EE/77-42) Avail: NTIS HC A08/MF A01 CSCL 17/7

This report investigates forms of the state noise covariance matrix in the Kalman filter. This matrix, denoted Q sub d, incorporates the effects of random errors driving the system dynamics into the filter computations. The Q sub d matrix is derived by integration from the matrix of continuous time driving noise strengths, which normally includes only diagonal terms. This often leads to use of a diagonal Q sub d matrix with constant terms. However, the derivation shows that Q sub d should have off-diagonal and time varying terms. The study investigates the effects of including such terms in Q sub d. Three alternate forms of Q sub d are derived for a specific

inertial navigation system. These, and a standard diagonal form, are tested using a covariance analysis. The results show little difference in performance for the different filters. This is attributed to two primary factors: highly accurate external measurements, and the use of integration sub-intervals for covariance propagation. GRA

N78-32082# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

A KALMAN FILTER DESIGN FOR THE SPACE SHUTTLE ORBITER INERTIAL MEASURING UNIT DURING DEORBIT/REENTRY USING GLOBAL POSITIONING SYSTEM SATELLITE INFORMATION M.S. Thesis

Dennis A. VanLiere Dec. 1977 183 p refs
(AD-A055465; AFIT/GGC/EE/77-10) Avail: NTIS HC A09/MF A01 CSCL 22/2

This report studies three Kalman Filter implementations for the deorbit/reentry phase of a Space Shuttle Orbiter mission profile. Each design uses measurements from Global Positioning System satellites to update Kalman Filter estimates of selected error states and to bound the Shuttle's INS error growth. Covariance analysis techniques are used to compare the performances of 17 state, 11 state, and 8 state filter designs using a digital computer simulation of a NASA OFT-1 Space Shuttle mission trajectory. A 73 state truth model of the Space Shuttle IMU, the Orbiter GPS receiver Master Tuning Unit, and the GPS satellite constellation is used as a system simulation to examine the performance of the design filters. The results are shown primarily in the form of computer-generated plots of both filter indicated errors and true system errors versus time. It is concluded from the results that an 8 state filter design is able to perform well enough to be a primary candidate for design implementation, and also that further refinements are necessary in the user clock model of the design Kalman Filter.
Author (GRA)

N78-32083# Coast Guard Research and Development Center, Groton, Conn.

A STUDY OF AERIAL SEMI-PRECISE SURVEY SYSTEMS FOR POSITION AUDITING OF COAST GUARD AIDS TO NAVIGATION Final Report, Mar. - May 1976

F. Giovane Oct. 1977 34 p refs
(AD-A055566; CGR/DC-25/77; USCG-D-61-77) Avail: NTIS HC A03/MF A01 CSCL 17/7

A study was undertaken to evaluate aerial imaging systems capable of establishing the position of aids to navigation to within 30 meters within 48 hours following adverse weather conditions such as ice or storm. A scenario area (400 km by 3 km) was created to simulate a region affected by such environmental conditions. The study considered aerial photograph, side-looking airborne radar, and visual observations from aircraft. It was concluded that there are no systems currently available to the Coast Guard to achieve an aerial semi-precise survey of aids to navigation. Author (GRA)

N78-32084# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

TERRAIN CONTOUR MATCHING (TERCOM): SENSITIVITY TO HEADING AND GROUND-SPEED ERRORS Final Report, Mar. 1975 - Aug. 1977

Mark W. Cannon, Jr. May 1978 25 p refs
(AF Proj. 7233)
(AD-A056127; AMRL-TR-77-84) Avail: NTIS HC A02/MF A01 CSCL 17/7

A simulation of the TERCOM navigation system is presented and the effects of a number of error sources are studied. Two error sources are course heading and ground-speed variation. A third source is the fact that the radar altimeter samples the terrain at geographical coordinates lying between coordinates that specify the locations of terrain altitudes stored in the on-board computer. The latter is shown to be an insignificant error with the 400 ft distance between sample points. Course heading and ground-speed errors are shown to be critical problems when they occur simultaneously. Maximum acceptable errors are approximately two degrees course heading at + or - 3% expected ground speed. Author (GRA)

N78-32085# National Technical Information Service, Springfield, Va.

AIR TRAFFIC CONGESTION AND CAPACITY. A BIBLIOGRAPHY WITH ABSTRACTS Final Report, 1964 - May 1978

Guy E. Habercom, Jr. Jun. 1978 164 p Supersedes NTIS/PS-77/0567; NTIS/PS-76/0495; NTIS/PS-75/376 (NTIS/PS-78/0598/9; NTIS/PS-77/0567; NTIS/PS-76/0495; NTIS/PS-75/376) Avail: NTIS HC $28.00/MF $28.00 CSCL 01E

Present and predicted air traffic density and capacity were analyzed for both, enroute and in airport environments. Terminal area scheduling, runway queuing, and airspace regulation are discussed. (This updated bibliography contains 159 abstracts, 13 of which are new entries to the previous edition.) GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N78-32086* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

SUPERSONIC TRANSPORT Patent

Paul Coe, Jr., inventor (to NASA) Issued 6 Jun. 1978 7 p Filed 27 Aug. 1976 Supersedes N76-31219 (14 - 22, p 2826)
(NASA-Case-LAR-11932-1; US-Patent-4,093,156; US-Patent-Appl-SN-718244; US-Patent-Class-244-45A; US-Patent-Class-244-46; US-Patent-Class-244-218) Avail: US Patent Office CSCL 01C

An aircraft of supersonic transport configuration is described, featuring thrust vectoring in conjunction with wing apex segments used as canard surfaces during takeoff, landing, and low-speed flight. The angle of incidence of the wing apex segments, when the segments were functioning as canard surfaces, was variable with respect to the aircraft angle of attack. The wing apex segments furthermore formed a portion of the main wing panel swept leading edge when not functioning as canard surfaces. The combination of thrust vectoring and deployable wing apex segments resulted in increased aircraft range and improved low speed longitudinal stability while providing acceptable takeoff length capabilities. Official Gazette of the U.S. Patent Office

N78-32087*# Douglas Aircraft Co., Inc., Long Beach, Calif.

REFERENCE AIRCRAFT FOR ICAO WORKING GROUP E

Jul. 1978 81 p refs
(Contract NAS1-14624)
(NASA-CR-158929) Avail: NTIS HC A05/MF A01 CSCL 01C

The results of an advanced supersonic transport aircraft/engine integration study to be used as a detail preliminary design case to assist in the assessment of noise standards applicable to future supersonic transports are summarized. The design considered reflects the application of the advanced technologies which are projected to be available for program initiation in the 1980-1985 time period. Suppression characteristics included were obtained in simulated forward flight in the Rolls-Royce spin rig using a small scale model. The engine size selected produces a noise no greater than 108 EPNdB at any of the three Far Part 36 (Stage 2) defined measuring points and is sized slightly larger than the optimum cruise size to meet this noise constraint condition. J.M.S.

N78-32088# Nielsen Engineering and Research, Inc., Mountain View, Calif.

MODIFICATIONS AND IMPROVEMENTS IN A STRUCTURAL OPTIMIZATION SCHEME BASED ON AN OPTIMALITY CRITERION Final Report, 1 Mar. 1977 - 28 Feb. 1978

S. C. McIntosh, Jr. Jun. 1978 81 p refs
(Contract F49620-77-C-0055)
(AD-A055941; AFOSR-78-1115TR) Avail: NTIS HC A05/MF A01 CSCL 01/2

Three optimization algorithms based on optimality criteria are compared with an algorithm based on mathematical programming. Two of the optimality-criterion algorithms are adapted from previous work and the third is new. The example problem used is a simple 12-design-variable rectangular wing with three separate equality behavioral constraints: a fixed deflection at the tip under a transverse load, a fixed fundamental free-vibration frequency, and a fixed subsonic flutter speed. Minimum-gage constraints were also imposed. All of the algorithms gave virtually identical optimal designs. The optimality-criterion algorithms were generally more efficient than the mathematical-programming algorithm, although comparisons with more complicated problems are needed to establish clearly the degree of superiority. The problems currently being considered are discussed, and the research plan for the next year is briefly described. Author (GRA)

N78-32089# Technology, Inc., Dayton, Ohio.
ACQUISITION OF OPERATIONAL DATA DURING NOE MISSIONS Final Report, Sep. 1976 - Oct. 1977
Terry L. Cox and F. Joseph Giessler Apr. 1978 95 p refs
(Contract DAAJ02-76-C-0065)
(AD-A055922; USARTL-TR-78-3) Avail: NTIS HC A05/MF A01 CSCL 01/2

For the continued development and updating of the operational usage spectrum of Army helicopters, a UH-1H helicopter assigned to nap-of-the-earth (NOE) training missions at Fort Rucker, Alabama, was instrumented with an oscillograph and a photopanel recording system. Two oscillographs collectively recorded 20 different flight parameters, and a photopanel assembly monitored 9 other flight parameters; 14.9 hours of valid data over the NOE course were recorded. For the optimum representation and interpretation of the helicopter's performance, the data were processed by the Flight Condition Recognition (FCR) method. In this program, the FCR technique was used to identify 29 flight conditions (including maneuvers and operational categories). These included turns and steady-state flight according to the occurrence and duration of a single flight parameter or combinations of them, each in a specific range. The data presentation includes the operational usage spectrum expressed as the percentage of time in the flight condition categories and various graphic depictions of typical NOE mission profiles. GRA

N78-32090# Clarkson Coll. of Technology, Potsdam, N.Y.
DYNAMIC RESPONSE OF AIRCRAFT TO UNLOADED AND LOADED PAVEMENT PROFILES Final Report, May - Sep. 1977
William H. Highter and Mark R. Snyder Oct. 1977 65 p refs
(Contract F08635-77-C-0181)
(AD-A055703; CEEDO-TR-77-42) Avail: NTIS HC A04/MF A01 CSCL 01/3

This study sought to determine whether or not there exists a significant difference in the simulated dynamic response of an F-4C aircraft traversing either an unloaded (undeflected) or loaded (deflected) pavement profile. The Air Force computer code, TAXI, calculates the vertical accelerations at three points on an aircraft as the aircraft traverses a pavement profile. An unloaded pavement profile was determined on a 2100 foot-long test section at Eglin Air Force Base, Fla., by measuring elevations along the pavement at 2 foot intervals. Pavement deflections caused by a load cart equipped with an aircraft tire were measured at the same points that defined the unloaded profile. These deflections were then subtracted from the unloaded profile point for point to obtain the loaded profile traversed by an F-4C aircraft. It appears that there is no significant difference in the response of TAXI to unloaded and loaded pavement profiles at speeds up to 133.3 feet/second. At higher speeds some rejections of the mean do occur, but these are felt to be insignificant. It appears that the present Air Force practice of using unloaded pavement profiles for aircraft dynamic response simulation is acceptable and loaded pavement profiles need not be obtained for this purpose. GRA

N78-32091# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN EXTENDED KALMAN FILTER FIRE CONTROL SYSTEM AGAINST AIR-TO-AIR MISSILES, VOLUME 2 M.S. Thesis
Salvatore J. Cusumano and Manuel DePonte, Jr. Dec. 1977 353 p
(AD-A055637; AFIT/GE/EE/77-13-Vol-2) Avail: NTIS HC A16/MF A01 CSCL 19/5

This Appendix contains the graphical results of the Monte Carlo analysis of this study. The plots will be presented in sets. All sets will include the dynamic state error plots. GRA

N78-32092# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.
AIRCRAFT CONFIGURATIONS FOR HIGH-SPEED SHIPS
Thomas H. Boyd Dec. 1977 88 p refs
(AD-A055540; DTNSRDC/ASED-397) Avail: NTIS HC A05/MF A01 CSCL 01/3

An analytical study was conducted to establish high-speed ship compatible aircraft configurations and to determine their capabilities and limitations in Navy missions. The study was restricted to subsonic aircraft configurations. The interface problems and design constraints associated with the application of Navy aircraft to high-speed ships were identified. Current aircraft in the Navy inventory and proposed advanced concepts were reviewed for applicability. Three open-ocean scenarios using the high-speed potential of the surface effect ship were postulated, and associated airborne missions were identified and defined. Findings confirm that the high-speed ship offers a number of benefits relative to small air capable ships. Conventional takeoff and landing aircraft can operate from deck lengths less than 600 feet. Short takeoff and landing aircraft can operate efficiently from deck lengths below 200 feet. Vertical takeoff and landing aircraft acquire up to a 50 percent increase in load capability at deck length of 400 feet. Author (GRA)

N78-32093# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
PHYSICAL CHARACTERISTICS: AVIATION MATERIEL Test Operations Procedures
Roy L. Miller 27 Nov. 1977 16 p Supersedes MTP-7-3-500 and the aviation portions of TOP-1-3-504; TOP-1-3-505
(AD-A055803; TOP-7-3-500; MTP-7-3-500; TOP-1-3-504; TOP-1-3-505) Avail: NTIS HC A02/MF A01 CSCL 01/3

This document identifies testing methods and techniques necessary to determine the degree to which Army aviation materiel's physical characteristics are determined. Author (GRA)

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N78-32094*# Illinois Univ., Urbana-Champaign. Aviation Research Lab.
AVIONICS PERFORMANCE ANALYSIS: A HISTORICAL REVIEW AND A CURRENT ASSESSMENT OF FLIGHT INSTRUMENTATION AND CONTROL SYSTEMS IN CIVIL AVIATION Final Report
Jul. 1978 53 p refs
(Contract NAS1-15145)
(NASA-CR-145378) Avail: NTIS HC A04/MF A01 CSCL 01D

The role of flight instrumentation and control systems in the advancement of civil aviation to the safest form of commercial transportation is discussed. Safety, cost reduction, and increased capabilities provided by recent developments are emphasized. Cost/performance considerations are considered in terms of determining the relative values of comparable systems or the absolute worth of a system. J.M.S.

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N78-32095 Michigan Univ., Ann Arbor.
COMBUSTION AND EMISSION CHARACTERISTICS OF A GAS TURBINE COMBUSTOR Ph.D. Thesis
Prabhakar Bapusaheb Patil 1978 257 p
Avail: Univ. Microfilms Order No. 78-13719

Physical and chemical processes such as spray formation, fuel and air mixing, droplet evaporation, and gas phase chemical reactions occur simultaneously in a gas turbine combustor. By estimating the characteristic times associated with these processes it is shown that the flow can be divided into regions where only some of these processes are important. The analysis presented is for two adjoining regions; (1) the heat up region where the incoming air and liquid fuel are heated, and (2) the evaporation/combustion region where the fuel evaporates and subsequently burns. This simplified analysis shows that evaporation limits the rate of the combustion process. The analysis provides an expression for estimating the flame speed and, with a simple numerical procedure, predicts the profiles of temperature and liquid fuel fraction. It is shown that by including a simple chemical kinetic scheme, the profiles of CO and NO can also be predicted. Dissert. Abstr.

N78-32096*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.
COMPRESSOR SEAL RUB ENERGETICS STUDY Final Report, 8 Apr. 1977 - 8 Apr. 1978
W. F. Laverty May 1978 139 p refs
(Contract NAS 3-20613)
(NASA-CR-159424; PWA-5616) Avail: NTIS HC A07/MF A01 CSCL 21E

The rub mechanics of compressor abradable blade tip seals at simulated engine conditions were investigated. Twelve statistically planned, instrumented rub tests were conducted with titanium blades and Feltmetal fibermetal rubstrips. The tests were conducted with single stationary blades rubbing against seal material bonded to rotating test disks. The instantaneous rub torque, speed, incursion rate and blade temperatures were continuously measured and recorded. Basic rub parameters (incursion rate, rub depth, abradable density, blade thickness and rub velocity) were varied to determine the effects on rub energy and heat split between the blade, rubstrip surface and rub debris. The test data was reduced, energies were determined and statistical analyses were completed to determine the primary and interactive effects. Wear surface morphology, profile measurements and metallographic analysis were used to determine wear, glazing, melting and material transfer. The rub energies for these tests were most significantly affected by the incursion rate while rub velocity and blade thickness were of secondary importance. The ratios of blade wear to seal wear were representative of those experienced in engine operation of these seal system materials. Author

N78-32097*# General Electric Co., Cincinnati, Ohio.
AIRCRAFT GAS TURBINE LOW-POWER EMISSIONS REDUCTION TECHNOLOGY PROGRAM Final Report
W. J. Dodds, C. C. Gleason, and D. W. Bahr Oct. 1978 161 p refs
(Contract NAS3-20580)
(NASA-CR-135434; Doc-R78AEG408) Avail: NTIS HC A08/MF A01 CSCL 21E

Advanced aircraft turbine engine combustor technology was used to reduce low-power emissions of carbon monoxide and unburned hydrocarbons to levels significantly lower than those which were achieved with current technology. Three combustor design concepts, which were designated as the hot-wall liner concept, the recuperative-cooled liner concept, and the catalyst converter concept, were evaluated in a series of CF6-50 engine size 40 degree-sector combustor rig tests. Twenty-one configurations were tested at operating conditions spanning the design condition which was an inlet temperature and pressure of 422 K and 304 kPa, a reference velocity of 23 m/s and a fuel-air-ration of 10.5 g/kg. At the design condition typical of aircraft turbine engine ground idle operation, the best configurations of all three concepts met the stringent emission goals which were 10, 1, and 4 g/kg for CO, HC, and Nox, respectively. G.G.

N78-32098*# Grumman Aerospace Corp., Bethpage, N.Y.
LARGE SCALE STATIC TESTS OF A TILT-NACELLE V/STOL PROPULSION/ATTITUDE CONTROL SYSTEM
Jul. 1978 166 p refs Sponsored by NASA
(NASA-CR-152181; PDR-698-8) Avail: NTIS HC A08/MF A01 CSCL 21E

The concept of a combined V/STOL propulsion and aircraft attitude control system was subjected to large scale engine tests. The tilt nacelle/attitude control vane package consisted of the T55 powered Hamilton Standard Q-Fan demonstrator. Vane forces, moments, thermal and acoustic characteristics as well as the effects on propulsion system performance were measured under conditions simulating hover in and out of ground effect. G.Y.

N78-32099# Ford Motor Co., Dearborn, Mich.
BRITTLE MATERIALS DESIGN, HIGH TEMPERATURE GAS TURBINE. VOLUME 1: CERAMIC COMPONENT FABRICATION AND DEMONSTRATION Interim Report, 1 Jan. - 30 Sep. 1977
Arthur F. McLean and Robert R. Baker Mar. 1978 69 p refs 2 Vol.
(Contract DAAG46-71-C-0162; ARPA Order 1849)
(AD-A055252; AMMRC-TR-78-14-Vol-1; IR-12-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 21/5

The progress made on the DARPA Ceramic Turbine Testing Program is presented. Duo-density rotor fabrication continued with over 600 rotor blade rings injection molded utilizing the automatic solid state control system. Eleven duo-density ceramic turbine rotors were cold spin tested to qualify them for further hot running. Development of the hot spin rigs continued. A combustor flame-out problem and a durability problem with the rotor tip shroud/failure detector were resolved. An important engine test of a duo-density silicon nitride rotor was accomplished. Fabrication development on injection molding of stators and nose cones of 2.7g/cc density was continued on a limited basis. Testing of stationary components continued in both qualification and durability rigs. A complete set of silicon nitride stationary components consisting of a nose cone, two stators, two rotor tip shrouds and a second-stage stator centering ring completed the program objective of 175 hours at 1930 F plus 25 hours at 2500 F with over 40 lights. In addition, a silicon carbide stator successfully completed over 175 hours at 1930 F plus over 28 hours at 2500 F with 52 lights. GRA

N78-32100# Ford Motor Co., Dearborn, Mich.
BRITTLE MATERIALS DESIGN, HIGH TEMPERATURE GAS TURBINE. VOLUME 2: CERAMIC TURBINE ROTOR TECHNOLOGY Interim Report, Jan. - Sep. 1977
Arthur F. McLean and Robert R. Baker Mar. 1978 91 p refs 2 Vol.
(Contract DAAG46-71-C-0162; ARPA Order 1849)
(AD-A055276; AMMRC-TR-78-14-Vol-2; IR-12-Vol-2) Avail: NTIS HC A05/MF A01 CSCL 21/5

Investigations of the materials used to fabricate duo-density ceramic turbine rotors were conducted on injection molded reaction bonded and hot pressed silicon nitride. The injection molding process, utilized to fabricate rotor blade rings, was improved by optimizing the molding parameters with the automated control system and improving the molding mixture. The installation of nozzles, to apply mold release, and air blast jets, to clean the die and evenly distribute the mold release, resulted in a noticeable improvement in the surface finish of the blade rings. Duo-density turbine rotors were tested in the cold spin pit to evaluate the hot press to reaction sintered bond joints and the effect of I.D. voids, in the blade ring rim, on blade failure speeds. Degradation of the room temperature strength of the reaction bonded silicon nitride rotor blades was identified as resulting from the press-bonding operation. A procedure for determining whether statistically significant differences exist

between two sets of data, known as the 'Hypothesis Testing' was outlined. The test was applied to data from duo-density turbine rotors and showed that blade strength did deteriorate after the press-bonding operation. Use of proof-testing as a means of enhancing the accuracy of life predictions was discussed.
GRA

N78-32101# Naval Postgraduate School, Monterey, Calif.
A VALIDATION OF MATHEMATICAL MODELS FOR TURBOJET TEST CELLS Final Report
John Justin Walters and David W. Netzer Jun. 1978 61 p refs
(AD-A055991; NPS-67NT78061) Avail: NTIS HC A04/MF A01 CSCL 21/5

Previously developed one-dimensional and two-dimensional computer models for predicting turbojet test cell performance were compared with data obtained from a subscale test cell for the purpose of model validation. Comparisons were made for a variety of configurations and flow rates. A modified one-dimensional model was found to reasonably predict the variation of augmentation ratio with engine flow rate, although predicted magnitudes were consistently too small. The model incorporated excessive drag losses and an inaccurate jet spreading parameter for large engine-augmentor spacings. The two-dimensional model accurately predicted experimental velocity profiles, but over-predicted pressure variations, except for low engine exit Mach numbers. Author (GRA)

N78-32102# Naval Postgraduate School, Monterey, Calif.
STRESS ANALYSIS OF CERAMIC GAS TURBINE BLADES BY THE FINITE ELEMENT METHOD, PART 2 M.S. Thesis
John H. Preisel, Jr. Mar. 1978 130 p refs
(AD-A055538; NPS-69-78-010-Pt-2) Avail: NTIS HC A07/MF A01 CSCL 21/5

The complex geometry of many parts of a ceramic gas turbine engine and the need to known the stresses in these parts to a high degree of accuracy indicate that the finite element method should be employed. One analysis code used a finite element program based on an isoparametric 12 node brick. This allowed quadratic variation in one coordinate direction, but only linear variation in the other two coordinate directions. This introduced an artificial stiffness into the structure. This study was made to determine the effects of using a totally quadratic isoparametric brick, vice one which is quadratic in only one direction. A distributed load preprocessor was also developed and tested. FORTRAN 4 was used throughout. Author (GRA)

N78-32103# Mathtech, Inc., Bethesda, Md.
STUDY OF THE TURBINE ENGINE INDUSTRY Final Report
David W. Grissmer and Kwan H. Kim 31 Jan. 1978 189 p refs
(Contract MDA903-76-C-0220)
(AD-A055895; Rept-7050-DG-KK-78-FR-1-DOD) Avail: NTIS HC A09/MF A01 CSCL 21/5

This report provides a summary and analysis of original data from seven major US aircraft engine manufacturers over a time period 1960-75. Analysis of large and small engine production, surge capacity, costs, productivity, and industry structure was made and compared with historical trends and the use of econometric models. Emphasis was placed on the lead times, shortages, and roles of subcontractors, component availability, and materials. Author (GRA)

N78-32104# Advisory Group for Aerospace Research and Development, Paris (France).
TECHNICAL EVALUATION REPORT ON THE 51ST(B) PEP SPECIALISTS' MEETING OF THE PROPULSION AND ENERGETICS PANEL ON SEAL TECHNOLOGY IN GAS TURBINE ENGINES
B. Wrigley (Rolls-Royce Ltd., Derby, England) Jul. 1978 10 p refs Meeting held at London, 6-7 Apr. 1978
(AGARD-AR-123; ISBN-92-835-1289-8) Avail: NTIS HC A02/MF A01

The following topics are discussed in relation to aircraft and industrial gas turbines: (1) material technology, particularly as applied to main flow path blade tip seals; (2) user's view of seal technology; (3) measurements of seal behavior; (4) laboratory experiments; and (5) design aids. B.B.

N78-32105# Advisory Group for Aerospace Research and Development, Paris (France).
TECHNICAL EVALUATION REPORT ON THE 51ST (A) SPECIALISTS' MEETING OF THE PROPULSION AND ENERGETICS PANEL ON ICING TESTING FOR AIRCRAFT ENGINES
D. Tedstone Aug. 1978 8 p Meeting held at London, 3-4 Apr. 1978
(AGARD-AR-124; ISBN-92-835-1295-2) Avail: NTIS HC A02/MF A01

The Propulsion and Energetics 51st (A) Specialists' Meeting on Icing Testing for aircraft engines contains a survey of the thirteen papers presented. The discussions which followed each paper, as well as of the concluding Round Table Session, are included. Conclusions are drawn and recommendations made regarding future work. Author

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N78-32106*# Systems Technology, Inc., Mountain View, Calif.
COMPUTED RESPONSES OF SEVERAL AIRCRAFT TO ATMOSPHERIC TURBULENCE AND DISCRETE WIND SHEARS Final Report
Wayne F. Jewell, Robert L. Stapleford, and Robert K. Heffley Feb. 1977 79 p refs
(Contract NAS2-8889)
(NASA-CR-152185; STI-TR-1063-2) Avail: NTIS HC A05/MF A01 CSCL 01C

The computed RMS and peak responses due to atmospheric turbulence and discrete wind shears, respectively, are presented for several aircraft in different flight conditions. The responses are presented with and without the effects of a typical second order washout filter. A complete set of dimensional stability derivatives for each aircraft/flight condition combination evaluated is also presented. Author

N78-32107# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
PITCH RATE FLIGHT CONTROL FOR THE F-16 AIRCRAFT TO IMPROVE AIR-TO-AIR COMBAT M.S. Thesis
Michael A. Marchand Dec. 1977 180 p refs
(AD-A055417; AFIT/GGC/EE/77-7) Avail: NTIS HC A09/MF A01 CSCL 01/3

Digital simulations were developed to implement a pitch rate control system for the F-16 aircraft engaged in aerial gunnery. First, the EASY Modelling and Analysis Program by Boeing Computer Services was adapted to implement a longitudinal axis F-16 aircraft, flight control system, and pilot model. Comparison of closed loop system responses indicated a proposed pitch rate flight control configuration would improve target tracking performance. The Terminal Aerial Weapon Delivery Simulation (TAWNDS) program by McDonnell Douglas Corporation was adapted for the F-16 aircraft. An non-linear six-degree-of-freedom aircraft model, multi-axis flight control system, and multi-axis pilot model were developed to demonstrate target tracking capabilities. Eight different air-to-air scenarios were developed to simulate evasive encounters with a F-4 target aircraft. Time history target tracking errors indicated the improved tracking performance of the proposed pitch rate flight control configuration over the present normal acceleration configuration of the F-16 aircraft. Author (GRA)

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N78-32108 Virginia Univ., Charlottesville.
AERODYNAMIC STABILITY TESTING WITH MAGNETICALLY SUSPENDED MODELS Ph.D. Thesis
Desikan Bharathan 1977 130 p
Avail: Univ. Microfilms Order No. 7812113

The practicality of measuring aerodynamic stability derivatives using models suspended in a water-cooled electromagnetic suspension facility is examined. Two non-spinning models are tested in pitch and heave oscillation in a subsonic flow and both static and dynamic aerodynamic derivatives are determined from the measurements. The two models are 7 caliber and 5 caliber cone cylinders. Important factors in aerodynamic derivative measurements such as magnetic damping, position sensing, and position-control stability are discussed and a comprehensive description of the apparatus is presented.
Dissert. Abstr.

N78-32109# Bell Helicopter Co., Fort Worth, Tex.
AUTOMATIC INSPECTION, DIAGNOSTIC AND PROGNOSTIC AIDAPS: TEST CELL DATA COLLECTION AND TECHNICAL SUPPORT Final Report
J. V. Hickey Aug. 1977 471 p
(Contract DAAJ01-71-A-0335)
(AD-A055385; USAAVRADCOM-TR-78-4) Avail: NTIS HC A20/MF A01 CSCL 14/2

This report covers the work accomplished in direct support to the AIDAPS prototype development. Work covered includes: test cell data for the AIDAPS developer to use in determining diagnostic and prognostic logic; collection of engineering data and technical support for AIDAPS integration into the UH-1 and AH-1 aircraft; and providing technical representation at AIDAPS development sites. AIDAPS was intended for use in Army aircraft and was intended to be used to reduce maintenance cost and improve flight safety by continuous in-flight monitoring of aircraft subsystems. GRA

N78-32110# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
PSEUDO-RANGE MEASUREMENTS USED TO INCREASE THE SAMPLING RATE OF THE AIDED TRACK ALGORITHM M.S. Thesis
James M. Petek Dec. 1977 155 p refs
(AD-A055635; AFIT/GA/EE/77-4) Avail: NTIS HC A08/MF A01 CSCL 17/7

This thesis investigates the use of internally generated pseudo-range measurements to increase the sampling speed of a rate aided pointing and tracking system known as Aided Track. Six separate methods for generating pseudo-range measurements were developed for a two dimensional analysis of the problem. Five target scenarios of various complexity were used to test the systems. The results obtained indicate that the use of a pseudo-range measurement generated by using the internal estimate of range provided the best performance of all methods tested. This method demonstrated a definite improvement over the slower system when tracking highly maneuverable targets.
Author (GRA)

N78-32111# Scientific Service, Inc., Redwood City, Calif.
THE SHOCK TUNNEL: HISTORY AND RESULTS, VOLUME 1-5 Final Report, Jul. 1976 - Feb. 1978
C. Wilton, K. Kaplan, and B. L. Gabrielsen Feb. 1978 449 p refs
(Contract DCPA01-76-C-0311)
(AD-A055518; SSI-7618-1) Avail: NTIS HC A19/MF A01 CSCL 14/2

This report summarizes the results of a program conducted by the Defense Civil Preparedness Agency to determine blast resistance of wall panels typically found in existing structures. The objective of this program was to determine the blast sheltering capability of structures in the National Fallout Shelter Survey inventory and to obtain information which could be used to upgrade these structures. GRA

N78-32112# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.
WIND TUNNEL WALL INTERFERENCE Interim Report, 1 Apr. 1977 - 1 Apr. 1978
E. H. Dowell and D. B. Bliss 1978 50 p refs
(Grant AF-AFOSR-3337-77)
(AD-A055735; AFOSR-78-1057TR) Avail: NTIS HC A03/MF A01 CSCL 14/2

A progress report on two aspects of theoretical research on improved understanding and reduction of wind tunnel wall interference is given. In part 1, the compliant wall concept is studied for steady, two-dimensional supersonic flow. The compliant wall is modeled as a hinged plate with a torsional spring restraint. The combinations of flow dynamic pressure, wall geometry and wall compliance which lead to minimum wall interference with the flow over a lifting airfoil are identified. In part 2, an improved theoretical model for flow over and through a slotted wall is constructed. The model takes into account streamline curvature in the direction of flow as well as flow through the slot perpendicular to the direction of flow. The theoretical relationship which is obtained between pressure differential across the slot and mass flow through the slot shows both the linear and quadratic regimes observed in experiments. Quantitative agreement with existing experimental data is also encouraging. Author (GRA)

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N78-32113*# National Aeronautics and Space Administration, Washington, D. C.
BASIC APPROACHES TO AND TASKS OF SPACE TECHNOLOGY
A. S. Okhotin Sep. 1978 31 p refs Transl. into ENGLISH of "Osnovnyye Napravleniya i Zadachi Kosmicheskoy Teknologii", Rept. PR-300 Inst. of Space Res., Acad. of Sci. USSR, Moscow, 1976 p 1-33 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75546; PR-300) Avail: NTIS HC A03/MF A01 CSCL 22A

The high vacuum and weightlessness of outer space offer great possibilities for the new field of space technology. To take advantage of this, it is necessary to study such physical and chemical phenomena as diffusion, surface tension, heat exchange, and crystallization. The research shows the possibility of obtaining materials with a more perfect structure. Methods of treating materials can be used in space which are impossible on earth. Achievements in material science in outer space will have a large impact on the national economy. Author

N78-32114# Indian Inst. of Science, Bangalore.
SPACE SCIENCE, TECHNOLOGY AND APPLICATIONS: AN OVERVIEW
Shashi Kant Shrivastava, ed. and K. Kasturirangan, ed. Apr. 1978 223 p refs
Avail: NTIS HC A10/MF A01

An overview of space science and technology developments and their applications in the Indian Space Program are presented. Reports are addressed to such topics as: space dynamics; solar systems; earth's environment; evolution - stars and galaxies; X-ray astronomy; rocket systems; fluid mechanics; spacecraft design and maintenance; satellite systems and communication; remote sensing; control systems; mission operation and planning; and extraterrestrial life. For individual titles, see N78-32115 through N78-32136.

N78-32115# Indian Space Research Organization, Bangalore. Satellite Center.
INDIAN SPACE PROGRAM: AN OVERVIEW

Shiv Prasad Kosta *In* Indian Inst. of Sci. Space Sci., Technol. and Appl.: An Overview Apr. 1978 6 p refs (For primary document see N78-32114 23-12)
Avail: NTIS HC A10/MF A01

India's Space program has the objectives of initiating, developing and mastering space application and space technology, and to exploit their potentialities for the socio-economic development of the country. Important space application areas are listed and the organizational set-up is outlined. The evolution of Indian Space program is presented and important achievements and current projects are outlined. Some of the spin-offs from the program are listed. G.Y.

N78-32116# Indian Inst. of Science, Bangalore. Dept. of Aeronautical Engineering.
SPACE DYNAMICS **c13**
S. K. Shrivastava *In its* Space Sci., Technol. and Appl.: An Overview Apr. 1978 14 p refs (For primary document see N78-32114 23-12)
Avail: NTIS HC A10/MF A01

The success and cost effectiveness of a space mission demand, among other things, selection and achievement of the best orbit, determination of an optimal launch trajectory, and evolution of minimum-effort trajectory correction strategies. This report considers some aspects of such analyses. The report is outlined as follows: (1) classical mechanics - Newton's Laws, Principle of Virtual Work, D'Alembert's Principle, Lagrange's Equation, Hamilton's Principle and Equations, Euler's Equations for rotation of rigid bodies, Conservation Laws, Coordinate Systems; (2) flight mechanics - equations of motion, types of trajectories (vertical, inclined, gravity-turn, ballistic, optimal), design parameters, critical phases of a rocket flight, stage separation, re-entry; (3) Orbital mechanics - central force motion, inverse square field, two-body problem, orbit from burn-out condition, orbital elements and perturbations; (4) orbital operations - orbital selection, correction, transfer and station keeping, determination and Hohmann's Transfer. G.Y.

N78-32117# Indian Space Research Organization, Ahmedabad. Space Application Center.
THE EARTH'S ENVIRONMENT **c46**
P. N. Pathak *In* Indian Inst. of Sci. Space Sci., Technol. and Appl.: An Overview Apr. 1978 8 p refs (For primary document see N78-32114 23-12)
Avail: NTIS HC A10/MF A01

Descriptions of the following five topics are presented: (1) neutral atmosphere of the earth; (2) ionosphere; (3) geomagnetic field; (4) cosmic rays; and (5) sun and interplanetary space. G.Y.

N78-32118# Indian Space Research Organization, Bangalore. Satellite Center.
SOLAR SYSTEM EXPLORATION
K. Kasturirangan and T. M. K. Marar *In* Indian Inst. of Sci. Space Sci., Technol. and Appl.: An Overview Apr. 1978 4 p (For primary document see N78-32114 23-12)
Avail: NTIS HC A10/MF A01

Topics of discussion are: (1) members of the solar system; (2) techniques of solar system exploration; and (3) motivation for solar system exploration. G.Y.

N78-32119# Indian Space Research Organization, Bangalore. Satellite Center.
FORMATION AND EVOLUTION OF STARS **c90**
T. M. K. Marar *In* Indian Inst. of Sci. Space Sci., Technol. and Appl.: An Overview Apr. 1978 6 p refs (For primary document see N78-32114 23-12)
Avail: NTIS HC A10/MF A01

The following topics are addressed: (1) formation of stars; (2) energy generation stars - carbon cycle, proton-proton cycle; (3) H-R diagram; (4) evolution of stars; (5) explosive nucleosynthesis; and (6) evolution of the core. Also included is an appendix: life time of stars on the main sequence. G.Y.

N78-32120# Indian Space Research Organization, Bangalore. Satellite Center.
X-RAY ASTRONOMY **c89**
T. M. K. Marar *In* Indian Inst. of Sci. Space Sci., Technol. and Appl.: An Overview Apr. 1978 8 p refs (For primary document see N78-32114 23-12)
Avail: NTIS HC A10/MF A01

A early history of the study of celestial X-ray soruces is presented. This is followed by discussions on the following topics: (1) the X-ray şky; (2) X-ray emitting double stars; (3) supernovae remnants; (4) transient X-ray sources; (5) X-ray burst sources; (6) extragalactic astronomy; and (7) the diffuse X-ray background. G.Y.

N78-32121# Indian Space Research Organization, Bangalore. Satellite Center.
ELEMENTS OF ROCKET SYSTEM DESIGN FOR SPACE RESEARCH **c20**
R. M. Vasagam *In* Indian Inst. of Sci. Space Sci., Technol. and Appl.: An Overview Apr. 1978 6 p (For primary document see N78-32114 23-12)
Avail: NTIS HC A10/MF A01

Indian Space Research Organisation (ISRO) since its inception in early 60s, has been developing various single and multi-stage rocket systems for fulfilling the space mission requirements, and a brief account of the evolution of these systems is presented. G.Y.

N78-32122# Indian Inst. of Science, Bangalore. Dept. of Aeronautical Engineering.
ROCKET PROPULSION **c20**
H. S. Mukunda *In its* Space Sci., Technol. and Appl.: An Overiew Apr. 1978 20 p refs (For primary document see N78-32114 23-12)
Avail: NTIS HC A10/MF A01

Rocket propultion systems are analyzed. The analysis deals with solid and liquid rockets and propellants. The gas dynamics of the rocket engine is discussed. Other topics include motor dimensions, combustion chamber, chamber cooling, and feed systems - pressure fed and turbo pump fed systems. G.Y.

N78-32123# Indian Inst. of Science, Bangalore. Dept. of Aeronautical Engineering.
ROCKET STRUCTURES **c18**
S. Durvasula *In its* Space Sci., Technol. and Appl.: An Overview Apr. 1978 17 p refs (For primary document see N78-32114 23-12)
Avail: NTIS HC A10/MF A01

An attempt is made to focus attention on the features of structural practice as relevant to rocket structures and to give an overall view of the structural design aspects with particular emphasis on a few typical important facets of the approach to structural analysis and design. Estimation of loads and environmental conditions during ground operqtions and flight are considered. Analysis of overall structure, the type of construction to be adopted and the choice of materials and methods of fabrication are presented. Other topics discussed are: (1) dynamics and aeroelasticity; (2) vibration of overall vehicle; (3) aeroelastic divergence; (4) vibration and flutter of rocket fins; (5) vibration of shell configurations; (6) analytical techniques for solutions; (7) experimental techniques, tests and qualification aspects; and (8) reliability considerations. G.Y.

N78-32124# Indian Inst. of Science, Bangalore. Dept. of Aeronautical Engineering.
HYPERSONIC FLOWS **c02**
N. M. Reddy *In its* Space Sci., Technol. and Appl.: An Overview Apr. 1978 7 p refs (For primary document see N78-32114 23-12)
Avail: NTIS HC A10/MF A01

Effects of hypersonic flow are dealt with in order to highlight important features. Topics of discussion include: (1) inviscid flow over bodies: different flow regimes (free molecular flow, transition rarefied gas flow, and continuum flow); (2) characteristic features of hypersonic flows; (3) flow over slender bodies; (4) Newtonian Theory; (5) aerodynamic heating; (6) heating rates at hypersonic speeds; (7) stagnation point heat transfer rate; (8) hypersonic testing facilities; and (9) principle of operation of a shock tube/shock tunnel. G.Y.

N78-32125# Indian Inst. of Science, Bangalore. School of Automation.

SIMULATION AND CONTROL **c61**
I. G. Sarma *In its* Space Sci., Technol. and Appl.: An Overview Apr. 1978 12 p refs (For primary document see N78-32114 23-12)
Avail: NTIS HC A10/MF A01

The systems of simulation and control are analyzed. A synopsis of computer simulation: concepts, models and methodologies is presented. An overview of hybrid computation and simulation is also presented. The control and simulation of flight vehicles are discussed. Tables are presented to aid the discussions. They include: (1) comparison of features of analog and digital computers; (2) digital equivalency of analog computers; (3) classification of launch vehicle models; (4) structure of short period models; (5) control-structure interaction modeling; (6) digital approach to simulation; (7) hybrid approach to simulation; and (8) hybrid approach instructions and execution times. G.Y.

N78-32126# Indian Space Research Organization, Bangalore. Satellite Center.
ELEMENTS OF SPACECRAFT DESIGN **c18**
K. Kasturirangan *In* Indian Inst. of Sci. Space Sci., Technol. and Appl.: An Overview Apr. 1978 7 p (For primary document see N78-32114 23-12)
Avail: NTIS HC A10/MF A01

An space mission involves a set of interactive technical elements that include a spacecraft with appropriately chosen payloads, a compatible launch vehicle system and a network of ground based telemetry, telecommand and tracking systems. The starting point for the definition of the configuration of these elements is a set of specific ggoals that the specific mission is expected to fulfill. A short summary of the various related possibilities is given. In subsequent sections of this paper attention is primarily focused on earth orbiting satellites, leaving deep space probes, lunar spacecrafts, etc., out of discussion. G.Y.

N78-32127# Indian Space Research Organization, Bangalore. Satellite Center.
SPACECRAFT MECHANICAL SYSTEMS **c18**
A. V. Patki *In* Indian Inst. of Sci. Space Sci., Technol. and Appl.: An Overview Apr. 1978 10 p (For primary document see N78-32114 23-12)
Avail: NTIS HC A10/MF A01

The spacecraft consists of three elements - the payload, the housekeeping systems and the supporting systems. The major supporting systems of a spacecraft are structure and thermal control. The two lectures presented are devoted to covering the general considerations involved while designing and developing these systems, the first one dealing with structure, and the second with thermal control. G.Y.

N78-32128# Indian Space Research Organization, Bangalore. Satellite Center.
SATELLITE ATTITUDE CONTROL **c15**
P. S. Goel *In* Indian Inst. of Sci. Space Sci., Technol. and Appl.: An Overview Apr. 1978 12 p refs (For primary document see N78-32114 23-12)
Avail: NTIS HC A10/MF A01

Satellite attitude control systems are divided into two categories - passive and active control systems. The various elements which contribute to each type of system are discussed. For the passive control system they are: (1) spin stabilization; (2) magnetic attitude control - magnetic field of the Earth, magnetic attitude stabilization, magnetic bias controk and spin axis orientation control; (3) gravity gradient stabilization - gravity gradient torques, basic dynamic equations for a rigid body, gravity gradient stabilization (two cases: circular and elliptical orbits), and physical considerations; (4) other passive stabilization techniques - aerodynamic torque, and solar radiation pressure. For the active control systems they are: (1) reaction wheel systems, mass expulsion systems, and gyrotorquers. A brief description of the attitude control system for the satellite for earth observation (SEO) due to be launched by the end of 1978 is given. G.Y.

N78-32129# Indian Space Research Organization, Bangalore. Satellite Center.
SENSORS FOR SPACE **c19**
T. K. Alex *In* Indian Inst. of Sci. Space Sci., Technol. and Appl.: An Overview Apr. 1978 9 p (For primary document see N78-32114 23-12)
Avail: NTIS HC A10/MF A01

Sensors used onboard spacecraft are discussed. The sensors used for space application are classified in general as sensors for: (1) electrical parameters; (2) mechanical parameters; (3) remote sensing; (4) scientific investigation; and (5) spacecraft dynamics. This paper briefly describes all of these and only the last is given in detail. G.Y.

N78-32130# Indian Space Research Organization, Bangalore. Satellite Center.
SPACECRAFT ELECTRONIC SYSTEMS, 1 **c33**
R. Ashiya *In* Indian Inst. of Sci. Space Sci., Technol. and Appl.: An Overview Apr. 1978 14 p (For primary document see N78-32114 23-12)
Avail: NTIS HC A10/MF A01

Discussion on the following topics is presented for the first part of this report: (1) space communication link - choice of frequency, constraints (environmental, launch vehicle, spacecraft and ground stations); (2) TTC system (telemetry-tracking and command system) - telemetry systems (FM/FM, PCM, PAM/FM, PDM/FM, PCM/FM), bandwidth and noise, and information handling capabilities; (3) telecommand systems - tone and tone digital command systems, coding, hamming distance, parity check, bit error rate and command system performance; (4) technologies used in space electronic systems; (5) testing philosophy of space electronic systems - environmental test philosophy for demonstrating reliability, and environmental test program. A second part is presented which deals with electronic systems as they relate to ground support facilities. Topics of discussion are ground checkout; ground stations; tracking systems and compatibility tests. G.Y.

N78-32131# Indian Space Research Organization, Bangalore. Satellite Center.
SPACECRAFT POWER SYSTEMS **c20**
R. Ashiya *In* Indian Inst. of Sci. Space Sci., Technol. and Appl.: An Overview Apr. 1978 7 p refs (For primary document see N78-32114 23-12)
Avail: NTIS HC A10/MF A01

Topics of discussion include sources of electrical power; solar radiation; solar cells - current trends and effects of environment; solar panels; interconnection of solar cells and panels; support structure; solar cell array configuration; chemical batteries; fuel cell systems; power conditioning (converters, regulators, battery charger, power control unit) and typical spacecraft power system design. G.Y.

N78-32132# Indian Space Research Organization, Bangalore. Satellite Center.
MISSION OPERATIONS AND PLANNING FOR SPACECRAFT PROJECTS
A. S. Prakasarao *In* Indian Inst. of Sci. Space Sci., Technol. and Appl.: An Overview Apr. 1978 7 p (For primary document see N78-32114 23-12)
Avail: NTIS HC A10/MF A01

Outlined and discussed are the various mission planning elements which are performed prior to space missions, such as orbit selection; vehicle selection; telemetry, telecommand, and tracking network determination; and data processing configurations. Flow charts are presented to give clarity to the discussion. G.Y.

N78-32133# Indian Space Research Organization, Bangalore.
OPPORTUNITIES TO UTILISE THE SPACE SHUTTLE TRANSPORT SYSTEM BY THE INDIAN SCIENTISTS **c16**
Y. S. Rajan *In* Indian Inst. of Sci. Space Sci., Technol. and Appl.: An Overview Apr. 1978 9 p (For primary document see N78-32114 23-12)
Avail: NTIS HC A10/MF A01

A description of the Space Shuttle Flight System is presented. A discussion on Spacelab and the Indian involvement and utilization of Spacelab is also discussed. An appendix is provided which gives orbital Flight Tests profiles, tentative plans for flights 7 through 17, characteristics of the Space Transportation System (shuttle characteristics) and cost data. G.Y.

N78-32134# Indian Inst. of Science, Bangalore.
REMOTE SENSING **c43**
Y. V. Venkatesh *In its* Space Sci., Technol. and Appl.: An Overview Apr. 1978 11 p refs (For primary document see N78-32114 23-12)
Avail: NTIS HC A10/MF A01

A lecture is presented and attempts to enumerate how, in man-made remote sensing systems, the data are acquired, how they are modified and, above all, how they can be organized, analyzed and interpreted to provde new information. Of particular value and interest to the engineer, plannar and resource manager are remote sensing systems that supply information about the terrestrial environment from aerial or space vantage point. The following topics are discussed: (1) fundamentals of remote sensing; (2) idealized remote sensing systems; (3) energy sources; (4) target interactions; (5) atmospheric effects; (6) practical remote sensing systems - multi-band photographic system, radiometers, scanners, side-looking airborne radar, passive microwave systems; and (7) data processing. G.Y.

N78-32135# Indian Inst. of Science, Bangalore. Space Segment Project Office.
SATELLITE COMMUNICATIONS **c32**
M. K. Saha *In its* Space Sci., Technol. and Appl.: An Overview Apr. 1978 17 p (For primary document see N78-32114 23-12)
Avail: NTIS HC A10/MF A01

Records of a lecture are presented which covered the following: (1) brief historical outline on the development of satellite communications; (2) various communication satellite systems; (3) some aspects of multiple systems link design; and (4) future trends in satellite communications sytems. G.Y.

N78-32136# Maryland Univ., College Park. Lab. of Chemical Evolution.
LIFE BEYOND THE EARTH **c55**
Cyril Ponnamperuma *In* Indian Inst. of Sci. Space Sci., Technol. and Appl.: An Overview Apr. 1978 6 p Repr. from Astronaut. and Aeronaut., Nov. 1976 6 p (For primary document see N78-32114 23-12)
Avail: NTIS HC A10/MF A01

The existence of life on other planets as compared to the evolution of life on earth is discussed. The discussion is high-lighted by historical references to life science theoreticians and the Viking landing on and sampling of the Martian soil. Emphasis is placed on the biochemical existence of life, and laboratory experiments are sited in this area of life detection. G.Y.

N78-32137*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DEEP SPACE NETWORK Progress Report, May and June 1978
15 Aug. 1978 188 p refs
(Contract NAS7-100)
(NASA-CR-157608; DSN-PR-42-46) Avail: NTIS HC A09/MF A01 CSCL 22D

Tracking and data acquisition research and technology for the DSN is discussed. For individual titles, see N78-32138 through N78-32161.

N78-32138*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES **c14**
N. A. Renzetti *In its* The Deep Space Network 15 Aug. 1978 p 1-3 (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

The objectives, functions, and organization of the Deep Space Network are summarized; deep space station, ground communication, and network operations control capabilities are described. Author

N78-32139*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DSN VLBI SYSTEM, MARK 1-79 **c17**
B. D. L. Mulhall *In its* The Deep Space Network 15 Aug. 1978 p 5-17 (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 17B

Very long baseline interferometry is a new capability being implemented in the DSN to support flight project navigation requirements and provide station frequency standard stability monitoring of sufficient accuracy to effectively validate hydrogen maser performance. A description of the system and the phases of its implementation are provided. G.G.

N78-32140*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A TUTORIAL INTRODUCTION TO VERY LONG BASE-LINE INTERFEROMETRY (VLBI) USING BANDWIDTH SYNTHESIS **c17**
J. I. Molinder *In its* The Deep Space Network 15 Aug. 1978 p 16-28 refs (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 17B

The basic principles underlying very long baseline interferometry (VLBI) are described by using bandwidth synthesis. The basic signal processing approach is detailed. Summarized results show the tradeoff of measurement accuracy with spanned bandwidth, source strength, antenna size and efficiency, system noise temperature, and data volume. Minimization of required antenna time for a given baseline measurement accuracy is also discussed. G.G.

N78-32141*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VIKING EXTENDED MISSION SUPPORT **c14**
R. L. Gillette *In its* The Deep Space Network 15 Aug. 1978 p 29-32 (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

Deep Space Network support is detailed for Viking spacecraft activities and the Viking command and tracking system. Viking DSN Mark 3 data subsystem implementation related testing is also discussed. G.G.

N78-32142*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PIONEER MISSION SUPPORT **c14**
D. W. H. Johnston *In its* The Deep Space Network 15 Aug. 1978 p 33-36 (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

Ongoing Pioneer project operations (Pioneers 6 through 11) are briefly mentioned. The DSN prelaunch preparations and launch operations for the Pioneer Venus orbiter are described in detail, along with a brief update on the Pioneer Venus multiprobe launch and encounter preparations. G.G.

N78-32143*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HELIOS MISSION SUPPORT **c14**
P. S. Goodwin, G. M. Rockwell, and W. N. Jensen *In its* The Deep Space Network 15 Aug. 1978 p 37-39 ref (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

Deep Space Network support of Helios mission operations includes information on Helios-1's seventh perihelion, Helios-2's fifth perihelion, and other mission-related activities. G.G.

N78-32144*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ON IMPROVED RANGING **c32**
J. W. Layland, A. I. Zygielbaum, and W. P. Hubbard *In its* The Deep Space Network 15 Aug. 1978 p 40-44 refs (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 20N

The use of a 1 MHz range code and a narrow-passband IF filter reduces waveform distortion error by a factor of as much as 20. Along with this improvement in ranging precision, ranging accuracy is enhanced by nullifying many errors caused by equipment vagaries. The IF filter and concomitant modification of ranging system software (and in the case of the planetary ranging assembly, hardware) are the most cost-effective way of improving the current generation ranging system. G.G.

N78-32145*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ESTABLISHING A CELESTIAL VLBI REFERENCE FRAME. 1: SEARCHING FOR VLBI SOURCES **c17**
R. A. Preston, D. D. Morabito, J. G. Williams, M. A. Slade, A. W. Harris, S. G. Finley, L. J. Skjerve, L. Tanida, D. J. Spitzmesser, B. Johnson et al *In its* The Deep Space Network 15 Aug. 1978 p 46-56 refs (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 17B

The Deep Space Network is currently engaged in establishing a new high-accuracy VLBI celestial reference frame. The present status of the task of finding suitable celestial radio sources for constructing this reference frame is discussed. To date, 564

VLBI sources were detected, with 166 of these lying within 10 deg of the ecliptic plane. The variation of the sky distribution of these sources with source strength is examined. G.G.

N78-32146*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
JPL 2-TO-THE-20TH-POWER CHANNEL 300 MHz BANDWIDTH DIGITAL SPECTRUM ANALYZER c32
G. A. Morris, Jr. and H. C. Wilck *In its* The Deep Space Network 15 Aug. 1978 p 57-61 refs (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 20N

A million (two to the 20th power) channel, 300 MHz bandwidth, digital spectrum analyzer was considered. The design, fabrication, and maintenance philosophy of the modular, pipelined, fast fourier transform (FFT) hardware are described. The spectrum analyzer will be used to examine the region from 1.4 GHz to 26 GHz for radio frequency interference which may be harmful to present and future tracking missions of the Deep Space Network. The design has application to the search for extraterrestrial intelligence signals and radio science phenomena. G.G.

N78-32147*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
USE OF A PRIORI STATISTICS TO MINIMIZE ACQUISITION TIME FOR RFI IMMUNE SPREAD SPECTRUM SYSTEMS c65
J. K. Holmes and K. T. Woo *In its* The Deep Space Network 15 Aug. 1978 p 62-69 refs (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 12A

The optimum acquisition sweep strategy was determined for a PN code despreader when the a priori probability density function was not uniform. A psuedo noise spread spectrum system was considered which could be utilized in the DSN to combat radio frequency interference. In a sample case, when the a priori probability density function was Gaussian, the acquisition time was reduced by about 41% compared to a uniform sweep approach. G.G.

N78-32148*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
UNIBUS MONITOR FOR PDP 11 c60
M. D. Donner *In its* The Deep Space Network 15 Aug. 1978 p 70-12 (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 09B

A UNIBUS monitor was designed and constructed to facilitate development of hardware interfaces with the PDP 11 minicomputer. The monitor provides useful displays of UNIBUS conditions and provides the user with a flexible diagnostic tool. It can also serve as a simple display and data entry device, permitting extremely simple input/output (I/O) for development software. At this time, the monitor is being used with the DSN planetary radar system, which uses a PDP 11. G.G.

N78-32149*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSS 13 ANTENNA SUBSYSTEM AUTOMATION c33
H. Phillips, I. Crane, and P. Lipsius *In its* The Deep Space Network 15 Aug. 1978 p 73-75 (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 09C

Unattended station operation was implemented that permitted full operational control from the network operations center (NOCC). Sensors were installed in the mechanical subsystem to monitor critical functions and to permit automated premission checkout of the subsystem, automated reaction to component failure, and identification of failed components under control of the antenna pointing computer. This monitoring installation is a prototype for monitoring equipment to be installed throughout the DSN. G.G.

N78-32150*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FPLA MECHANIZATION OF ARITHMETIC ELEMENTS TO PRODUCE A + B OR TO PASS A ONLY c64
D. E. Wallis, H. Taylor, and A. L. Rubin *In its* The Deep Space Network 15 Aug. 1978 p 76-80 (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 12A

A 4-bit and a 3-bit adder are described which can be implemented under special hardware restrictions. The chip to be used is field-programmable logic array (FPLA) with 12 input lines, 50 AND gates inside, and output through only 6 OR gates. The context in which it is being used requires an enable function which can suppress one of the two numbers to be added. The 3-bit enabled adder is compatible with lookahead-carry mechanizations using the 74S182. G.G.

N78-32151*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A PROBABILISTIC SPERNER'S THEOREM, WITH APPLICATIONS TO THE PROBLEM OF RETRIEVING INFORMATION FROM A DATA BASE c65
L. D. Baumert, R. J. McEliece, E. R. Rodemich, and H. Rumsey, Jr. *In its* The Deep Space Network 15 Aug. 1978 p 81-86 refs (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 12A

The design of an optimal merged keycode data base information retrieval system is detailed. A probability distribution of n-bit binary words that minimized false drops was developed for the case where the set of desired records was a subset of tagged records. G.G.

N78-32152*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VLBI-LASER INTERCOMPARISON PROJECT c43
B. D. L. Mulhall *In its* The Deep Space Network 15 Aug. 1978 p 87-91 (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 08B

The VLBI-laser intercomparison system for assessing geodetic measurements is described. The primary objective of the DSN VLBI-laser intercomparison project is the accurate measurement of baseline vectors, both length and direction, between established geodetic benchmarks. A second objective is the intercomparison between both satellite and lunar laser ranging techniques with VLBI. G.G.

N78-32153*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A FAST COMPUTATION OF COMPLEX CONVOLUTION USING A HYBRID TRANSFORM c64
I. S. Reed (Univ. of Southern Calif., Los Angeles) and T. K. Truong *In its* The Deep Space Network 15 Aug. 1978 p 92-99 refs (For primary document see N78-32137 23-12)
(Grant AF-AFOSR-2798-75)
Avail: NTIS HC A09/MF A01 CSCL 12A

The cyclic convolution of complex values was obtained by a hybrid transform that is a combination of a Winograd transform and a fast complex integer transform. This new hybrid algorithm requires fewer multiplications than any previously known algorithm. G.G.

N78-32154*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE GRAVITATIONAL WAVE DETECTION EXPERIMENT: DESCRIPTION AND ANTICIPATED REQUIREMENTS c46
A. L. Berman *In its* The Deep Space Network 15 Aug. 1978 p 100-108 (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 08N

The experiment to detect gravitational waves in ultraprecise two-way Doppler data is described, as are the anticipated requirements for the Deep Space Network, the spacecraft, and the data processing system. The special feature which allows the usage of ultraprecise Doppler data for the possible detection of gravitational waves is a unique three-pulse signature which is a function of the spacecraft, earth, and gravitational wave propagation direction geometry. The pulses (fractional frequency shifts) result from effects which are conveniently described as follows: Clock speed-up (earth only effect) and buffeting (equal earth and spacecraft effect). G.G.

N78-32155*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PRELIMINARY ANALYSIS OF THE IMPACT OF POWER CYCLING ON CTA-21 EQUIPMENT RELIABILITY c33
E. R. Cole *In its* The Deep Space Network 15 Aug. 1978 p 109-114 refs (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 09C

The effects of power turn-off on Deep Space Station control room equipment were considered. Reliability analysis indicated that there may be some correlation between an observed increase in failure rate and cycling equipment power. G.G.

N78-32156*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DSS RADIO SCIENCE SUBSYSTEM: DATA HANDLING

OF VERY LONG BASELINE INTERFEROMETRY (VLBI) DATA **c32**
A. L. Berman *In its* The Deep Space Network 15 Aug. 1978 p 115-122 ref (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 17B

The key characteristics functional requirements, and operation of the radio science subsystem are discussed as they pertain to usage of deep radio sources by the DSN VLBI system. G.G.

N78-32157*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ABSOLUTE FLUX DENSITY CALIBRATIONS: RECEIVER SATURATION EFFECTS **c32**
A. J. Freiley, J. E. Ohlson (Naval Postgraduate School), and B. L. Seidel *In its* The Deep Space Network 15 Aug. 1978 p 123-129 refs (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 17B

The effect of receiver saturation was examined for a total power radiometer which uses an ambient load for calibration. Extension to other calibration schemes is indicated. The analysis shows that a monotonic receiver saturation characteristic could cause either positive or negative measurement errors, with polarity depending upon operating conditions. A realistic model of the receiver was made by using a linear-cubic voltage transfer characteristic. The evaluation of measurement error for this model provided a means for correcting radio source measurements. G.G.

N78-32158*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN PORTABLE ZERO DELAY ASSEMBLY **c14**
E. J. Serhal, Jr. and T. Y. Otoshi *In its* The Deep Space Network 15 Aug. 1978 p 130-138 refs (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

Design and test data on portable zero delay assemblies are reported. These assemblies are field-use delay standards to periodically calibrate the block 4 translator ranging paths at each 64-m antenna Deep Space Station. G.G.

N78-32159*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EVALUATION OF THE DEVELOPING DSN LIFE-CYCLE COST STANDARD PRACTICE **c38**
M. McKenzie *In its* The Deep Space Network 15 Aug. 1978 p 139-145 refs (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 14D

The DSN is developing a life-cycle cost standard practice by comparison to those of industry and the Department of Defense. Results show that the DSN uses the accepted concept of life-cycle costing, tailoring the concept to DSN specific needs, but does not push the concept past the point of prevailing theory. G.G.

N78-32160*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A BRIEF HISTORICAL INTRODUCTION TO VERY LONG BASELINE INTERFEROMETRY **c17**
B. Benjauthrit *In its* The Deep Space Network 15 Aug. 1978 p 146-153 refs (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 17B

A short history of VLBI is provided from the Michelson-Pease experiment of 1920 up to the present time. This includes the rationale, development, and various experiments behind the subject of VLBI. G.G.

N78-32161*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN EXTENSIVE BIBLIOGRAPHY ON LONG BASELINE INTERFEROMETRY **c17**
B. Benjauthrit *In its* The Deep Space Network 15 Aug. 1978 p 154-181 refs (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 17B

Long baseline interferometry has grown from a simple concept of an optical device for detecting light fringes to a highly theoretical and sophisticated system assisted by computers and modern electronic components. The areas of applications include radio astronomy, radio science, geodesy, tectonics, space navigation, and seismology. G.G.

N78-33023# Joint Publications Research Service, Arlington, Va.
PETROV COMMENTS ON SOYUZ-28 INTERNATIONAL CREW
B. Petrov *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 43 (JPRS--71652) 9 Aug. 1978 p 14-17 Transl. into ENGLISH from Pravda (Moscow), 5 Mar. 1978 p 3 (For primary document see N78-33021 23-99)
Avail: NTIS HC A04/MF A01

N78-33032# Joint Publications Research Service, Arlington, Va.
POLISH SALYUT EXPERIMENT PROGRAM DESCRIBED
Robert R. Galazka *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 45 (JPRS-71673) 14 Aug. 1978 p 19-23 Transl. into ENGLISH from Zycie Warszawy (Warsaw), Special Edition, Jun. 1978 p 4 (For primary document see N78-33030 23-99)
Avail: NTIS HC A04/MF A01

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N78-32162*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ORBIT SELECTION FOR EARTH OBSERVATION MISSIONS
Joseph C. King Jun. 1978 13 p refs
(NASA-TM-79581) Avail: NTIS HC A02/MF A01 CSCL 22A

The orbit selection process is simplified for most earth-oriented satellite missions by a restriction to circular orbits, which reduces the primary orbit characteristics to be determined to only two: altitude and inclination. A number of important mission performance characteristics depend on these choices, however, so a major part of the orbit selection task is concerned with developing the correlating relationships in clear and convenient forms to provide a basis for rational orbit selection procedures. The present approach to that task is organized around two major areas of mission performance, orbit plane precession and coverage pattern development, whose dependence on altitude and inclination is delineated graphically in design chart form. These charts provide a visual grasp of the relationships between the quantities cited above, as well as other important mission performance parameters including viewing time of day (solar), sensor swath width (and fields of view), swath sequencing, and pattern repeat condition and repeat periods. Author

N78-32116# Indian Inst. of Science, Bangalore. Dept. of Aeronautical Engineering.
SPACE DYNAMICS
S. K. Shrivastava *In its* Space Sci., Technol. and Appl.: An Overview Apr. 1978 14 p refs (For primary document see N78-32114 23-12)
Avail: NTIS HC A10/MF A01

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N78-32138*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES
N. A. Renzetti *In its* The Deep Space Network 15 Aug. 1978 p 1-3 (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

N78-32141*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VIKING EXTENDED MISSION SUPPORT
R. L. Gillette *In its* The Deep Space Network 15 Aug. 1978 p 29-32 (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

N78-32142*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PIONEER MISSION SUPPORT
D. W. H. Johnston *In its* The Deep Space Network 15 Aug. 1978 p 33-36 (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

N78-32143*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HELIOS MISSION SUPPORT
P. S. Goodwin, G. M. Rockwell, and W. N. Jensen *In its* The Deep Space Network 15 Aug. 1978 p 37-39 ref (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

N78-32158*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN PORTABLE ZERO DELAY ASSEMBLY
E. J. Serhal, Jr. and T. Y. Otoshi *In its* The Deep Space Network 15 Aug. 1978 p 130-138 refs (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 14B

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N78-32163*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IMS/SATELLITE SITUATION CENTER REPORT: SUMMARY OF IMS/SSC SPECIAL PERIODS AND THE POSITIONS OF IMS HIGH-ALTITUDE SATELLITES, DAYS 1 - 181 1978
Aug. 1978 123 p refs
(NASA-TM-79846; NSSDC/WDC-A-R/S-11) Avail: NTIS HC A06/MF A01 CSCL 22A

A concise and easily used description of the orbital positions is given of a number of high-altitude satellites capable of making magnetospheric measurements as part of the International Magnetospheric Study (IMS). The following high-altitude satellites are considered: Vela 5A, Vela 5B, Vela 6A, Vela 6B, Solrad 11B, IMP-H, IMP-J, and ISEE 1. A summary of the magnetopause and bow shock crossings and magnetotail positions of these satellites is given in tabular form. In addition, the IMS/Satellite Situation Center (SSC) Special Periods for the first half of 1978 are given, and detailed plots and bar charts illustrating these periods are presented. Although the Vela satellites have the possibility of poor data coverage, they are included because they continue to obtain useful data in the magnetotail and the region of the magnetopause. Solrad 11B is included because the solar wind detector was operating at the time the IMS/SSC Special Periods were generated, and the satellite potentially would obtain useful data in the interplanetary medium and near the boundaries. Subsequently, the detector failed in February 1978, and the value of this satellite to the IMS/SSC Special Periods beyond this date is limited. J.M.S.

N78-32164*# Rockwell International Corp., Downey, Calif. Satellite Systems Div.
SATELLITE POWER SYSTEMS (SPS) CONCEPT DEFINITION STUDY: SPS POINT DESIGN DEFINITION UPDATE
G. M. Hanley 30 Jul. 1978 106 p
(Contract NAS8-32475)
(NASA-CR-150690; SD-78-AP-0113) Avail: NTIS HC A06/MF A01 CSCL 22A

The Rockwell International Photovoltaic Satellite Based Satellite Power System (SPS) Point Design as it is defined through July 1978 is described. The point design to be presented is the result of a series of trade studies. The data established during the period May through July 1978 is incorporated in this summary document. The system relationship of the total Satellite Power System is depicted. This document discusses only the first two elements: the satellite and ground systems. G.Y.

N78-32165*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
STATION POSITION RESULTS USING CONCENTRATED C-BAND TRACKING OF GEOS-3
W. B. Krabill and C. F. Martin (Washington Analytical Services Center, Inc., Riverdale, Md.) Sep. 1978 25 p refs
(NASA-TM-73277) Avail: NTIS HC A02/MF A01 CSCL 22A

Station positions for the GEOS 3 C Band tracking network were estimated using C Band and laser data taken during a two-week concentrated tracking period. The C Band stations are located primarily in the continental United States and on Western Atlantic islands. The network, however, included stations in Hawaii, in West Germany, and on Kwajalein atoll. Estimated accuracies for the recovered positions are 2 m for the continental U. S. and Atlantic sites, 5 m for Hawaii, and 10 m for Kwajalein. The dominant contributor to these uncertainties is geopotential model error. Thus, the C Band/laser data set could be used for more accurate center-of-mass positioning of a continental network of stations. J.M.S.

N78-32166*# RCA Government and Commercial Systems, Moorestown, N. J. Governmental and Commercial Systems Div.
GEOS-3 C-BAND RADAR INVESTIGATIONS Final Report
Donald J. Dempsey Sep. 1978 42 p
(Contract NAS6-2637)
(NASA-CR-156841) Avail: NTIS HC A03/MF A01 CSCL 22A

The absolute accuracy of instrumentation radar systems, refined methods of calibrating these systems, and the techniques employed in processing the associated data. A world-wide network of C-Band instrumentation radars augmented by lasers and other tracking instrumentation systems were used. The NASA WFC AN/FPQ-6 instrumentation radar and the AN/FPS-16 instrumentation radar also located at NASA WFC were the primary instruments used in the accuracy and calibration evaluations. The results achieved at WFC were then disseminated to other Ranges where they were verified, augmented and used as part of routine operations. J.M.S.

N78-32167*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
GEOS-3 COHERENT C-BAND TRACKING DATA REDUCTION AND ANALYSIS Final Report
W. B. Krabill and K. L. Borman (Washington Analytical Services Center, Inc., Riverdale, Md.) Sep. 1978 65 p refs
(NASA-TM-73278) Avail: NTIS HC A04/MF A01 CSCL 22A

The availability of a coherent C-Band transponder on an orbiting vehicle has permitted the development of calibration techniques for C-Band radars. Prior coherent tracking was limited to test vehicles in powered flight or skin tracking of orbiting spacecraft. The pulse Doppler range rate data available concurrently and independently with normal range and angle data provides an extremely useful data set for assessing the internal consistency of the radars measurements, particularly when coupled with a trajectory well constrained by orbit dynamics. In order to further assess the precision of the range rate data, a technique was developed to numerically integrate the rate measurements into a pseudo-range data set showing extremely low noise and high sensitivity to systematic radar errors. Evaluation of integrated range data led to improvements in calibration of both the rate and conventional range data. In particular, proper evaluation of the very sensitive integrated ranges required the development of a processing correction for beacon delay variation with signal strength, a significant error in the conventional ranging data.
Author

N78-32168*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
HYPERSONIC AIRBREATHING MISSILE Patent Application
James L. Hunt, Pierce L. Lawing, and Don C. Marcum, Jr., inventors (to NASA) Filed 18 Sep. 1978 21 p
(NASA-Case-LAR-12264-1; US-Patent-Appl-SN-943087) Avail: NTIS HC A02/MF A01 CSCL 16D

A hypersonic airbreathing missile using dual mode scramjet engines for propulsion is described. The fuselage is constructed of a material with a high heat sink capacity and is covered with a thermal protective shield and lined with an internal insulating blanket. The engine airframe integration uses the flat lower portion of the lower fuselage to precompress the air entering

the scramjet engines. The precompression of air entering the scramjet inlets increases as the angles of attack. This feature results in a highly maneuverable missile which can accelerate as it banks into a turn. NASA

N78-32169# Army Missile Research and Development Command, Redstone Arsenal, Ala. Engineering Lab.
A METHOD FOR VALIDATING MISSILE SYSTEM SIMULATION MODELS
Thomas P. Tytula Jun. 1978 122 p refs
(DA Proj. 1T1-61101-A-91A)
(AD-A055689; DRDMI-E-78-11) Avail: NTIS HC A06/MF A01 CSCL 12/1

A method for deciding whether a missile system simulation model is sufficiently accurate for a specific purpose is presented. The procedure uses time series models of test data to generate empirical distributions which can be compared to distributions obtained from simulation models. Time series models are also used to generate empirical distributions of the error between simulated and test data. These error distributions can then be used in decision models to decide whether the simulation model is valid for a specific purpose. Examples demonstrate the validity of the time series transformation and illustrate its application to missile system data. Author (GRA)

N78-32170# Analytic Sciences Corp., Reading, Mass.
MISSILE GUIDANCE SYSTEM TRANSFORMATION EQUATIONS
J. E. Gibbons 1 Aug. 1977 25 p Prepared for California Univ., Lawrence Livermore Lab.
(Contract W-7405-eng-48)
(UCRL-13827; TR-772-1-2) Avail: NTIS HC A02/MF A01

Factors affecting the effectiveness of missile forces are presented, along with an overview of the principal phases of the ICBM flight test program. The principal technical results provide the mathematical basis for relating individual error descriptions in the various coordinate systems used. ERA

N78-32171# ICL Dataskil Ltd., Reading (England).
EUROPEAN ARRAY PROCESSORS FOR SEASAT
D. Parkinson Paris ESA Oct. 1977 71 p
(Contract ESA-3155/77)
(ESA-CR(P)-1066) Avail: NTIS HC A04/MF A01

European digital processors capable of processing SEASAT a Synthetic Aperture Radar (SAR) data were studied. Four commercially available processing systems were considered and it is shown that all four have the potential required. Systems CR-80 of Christian Rovsing (Denmark) and APS of PCS (Germany) consist of floating processors. Both are available on slightly less than one year delivery at a cost of approximately 1 MAU (million accounting units). The power is only just adequate for the SEASAT tasks and, hence, such solutions must be considered to be of high risk. The PCS system is recommended as it has the lowest cost, slightly more power, and a smaller development content. The systems PROPAL-2 of CII (France) and DAP of ICL (U.K.) are based on multiple elementary bit serial processors. The delivery of both is two years with cost 1.5 to 2 MAU. The power of these systems is considerably greater than the other systems. The ICL solution is recommended as it has the minimum amount of special development and is the most flexible system.
Author (ESA)

N78-32128# Indian Space Research Organization, Bangalore. Satellite Center.
SATELLITE ATTITUDE CONTROL
P. S. Goel *In* Indian Inst. of Sci. Space Sci., Technol. and Appl.: An Overview Apr. 1978 12 p refs (For primary document see N78-32114 23-12)
Avail: NTIS HC A10/MF A01

N78-33017# Joint Publications Research Service, Arlington, Va.
GUARANTEE OF THE RELIABILITY OF ORBITAL STATIONS
V. Simayev *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 42 (JPRS-71612) 3 Aug. 1978 p 48-53 Transl. into ENGLISH from Aviat. Kosmonavt. (Moscow), no. 6, 1978 p 34-35 (For primary document see N78-33015 23-99)
Copyright. Avail: NTIS HC A05/MF A01

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N78-32172*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AN INDUCED ENVIRONMENT CONTAMINATION MONITOR FOR THE SPACE SHUTTLE
Edgar R. Miller, ed. and Rudolf Decher, ed. Aug. 1978 175 p refs
(NASA-TM-78193) Avail: NTIS HC A08/MF A01 CSCL 22B

The Induced Environment Contamination Monitor (IECM), a set of ten instruments integrated into a self-contained unit and scheduled to fly on shuttle Orbital Flight Tests 1 through 6 and on Spacelabs 1 and 2, is described. The IECM is designed to measure the actual environment to determine whether the strict controls placed on the shuttle system have solved the contamination problem. Measurements are taken during prelaunch, ascent, on-orbit, descent, and postlanding. The on-orbit measurements are molecular return flux, background spectral intensity, molecular deposition, and optical surface effects. During the other mission phases dew point, humidity, aerosol content, and trace gas are measured as well as optical surface effects and molecular deposition. The IECM systems and thermal design are discussed. Preflight and ground operations are presented together with associated ground support equipment. Flight operations and data reduction plans are given. J.M.S.

N78-32173*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AERODYNAMIC ROLL CHARACTERISTICS OF A 0.00548 SCALE 146-INCH SOLID ROCKET BOOSTER REENTRY CONFIGURATION (MSFC MODEL NUMBER 486) OVER A PORTION OF THE REENTRY FLIGHT REGIME IN THE NASA MSF 14-INCH TRISONIC WIND TUNNEL
Paul E. Ramsey Jun. 1977 139 p
(NASA-TM-78195) Avail: NTIS HC A07/MF A01 CSCL 01A

An experimental investigation was conducted in the MSFC 14 inch TWT to study the roll characteristics of a 0.00548 scale model of the 146 inch shuttle solid rocket booster to obtain more accurate rolling moment data on the solid rocket booster. A sensitive single component roll balance was utilized. Data were obtained for a single nose mounted sting. The angle of attack range consisted of angles from 150 deg to 190 deg; roll angles consisted of angles from 0 deg to 337 1/2 deg in increments of 22 1/2 deg; and Mach numbers were 1.46, 1.96, 2.74 and 2.48. B.B.

N78-32174*# Teledyne Brown Engineering, Huntsville, Ala. Space Systems Dept.
STS PAYLOAD DATA COLLECTION AND ACCOMMODATIONS ANALYSIS STUDY. VOLUME 1: EXECUTIVE SUMMARY Final Report
Aug. 1978 23 p refs 3 Vol.
(Contract NAS8-32711)
(NASA-CR-150815; ES78-MSFC-2241-Vol-1) Avail: NTIS HC A02/MF A01 CSCL 22A

The requirements of investigations/instruments and integrated missions to be flown on the Space Transportation System (STS) and the accommodations/resources on the STS actually available for use by these investigations and missions are identified. Deficiencies, areas of concern, and needed improvements in the STS are considered in terms of requirements versus accommodations. A data base developed for investigations/instruments considered in mission planning activities for OSTA is described. J.M.S.

N78-32175*# Teledyne Brown Engineering, Huntsville, Ala. Space Systems Dept.
STS PAYLOAD DATA COLLECTION AND ACCOMMODA-

TIONS ANALYSIS STUDY. VOLUME 2: PAYLOAD DATA COLLECTION Final Report
Aug. 1978 82 p refs 3 Vol.
(Contract NAS8-32711)
(NASA-CR-150816; ES78-MSFC-2241-Vol-2) Avail: NTIS HC A05/MF A01 CSCL 22A

A format developed for Space Transportation System payload data collection and a process for collecting the data are described along with payload volumes and a data deck to be used as input for the Marshall Interactive Planning System. Summary matrices of the data generated are included. J.M.S.

N78-32176*# Teledyne Brown Engineering, Huntsville, Ala. Space Systems Dept.
STS PAYLOAD DATA COLLECTION AND ACCOMMODATIONS ANALYSIS STUDY. VOLUME 3: ACCOMMODATIONS ANALYSIS Final Report
Aug. 1978 49 p refs 3 Vol.
(Contract NAS8-32711)
(NASA-CR-150817; ES78-MSFC-2241-Vol-3) Avail: NTIS HC A03/MF A01 CSCL 22A

Payload requirements were compared to launch site accommodations and flight accommodations for a number of Spacelab payloads. Experiment computer operating system accommodations were also considered. A summary of accommodations in terms of resources available for payload discretionary use and recommendations for Spacelab/STS accommodation improvements are presented. J.M.S.

N78-32177*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SPACE SHUTTLE SEPARATION MECHANISMS
William F. Rogers Sep. 1978 26 p ref
(NASA-TM-58210) Avail: NTIS HC A03/MF A01 CSCL 22B

The development of space shuttle separation devices is reviewed to illustrate the mechanisms involved in separating the Orbiter from the Boeing 747 carrier aircraft and from the externally mounted propellant tank. Other aspects of the separation device development discussed include design evolution, operational experience during the orbiter approach and landing tests, and the work required to produce an operational system. Author

N78-32133# Indian Space Research Organization, Bangalore.
OPPORTUNITIES TO UTILISE THE SPACE SHUTTLE TRANSPORT SYSTEM BY THE INDIAN SCIENTISTS
Y. S. Rajan *In* Indian Inst. of Sci. Space Sci., Technol. and Appl.: An Overview Apr. 1978 9 p (For primary document see N78-32114 23-12)
Avail: NTIS HC A10/MF A01

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N78-32139*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DSN VLBI SYSTEM, MARK 1-79
B. D. L. Mulhall *In its* The Deep Space Network 15 Aug. 1978 p 5-17 (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 17B

N78-32140*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A TUTORIAL INTRODUCTION TO VERY LONG BASE-LINE INTERFEROMETRY (VLBI) USING BANDWIDTH SYNTHESIS
J. I. Molinder *In its* The Deep Space Network 15 Aug. 1978 p 16-28 refs (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 17B

N78-32145*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ESTABLISHING A CELESTIAL VLBI REFERENCE FRAME. 1: SEARCHING FOR VLBI SOURCES
R. A. Preston, D. D. Morabito, J. G. Williams, M. A. Slade, A. W. Harris, S. G. Finley, L. J. Skjerve, L. Tanida, D. J. Spitzmesser, B. Johnson, et al *In its* The Deep Space Network 15 Aug. 1978 p 46-56 refs (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 17B

N78-32160*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A BRIEF HISTORICAL INTRODUCTION TO VERY LONG BASELINE INTERFEROMETRY
B. Benjauthrit *In its* The Deep Space Network 15 Aug. 1978 p 146-153 refs (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 17B

N78-32161*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN EXTENSIVE BIBLIOGRAPHY ON LONG BASELINE INTERFEROMETRY
B. Benjauthrit *In its* The Deep Space Network 15 Aug. 1978 p 154-181 refs (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 17B

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N78-32178*# Martin Marietta Corp., Denver, Colo.
VIKING DYNAMICS EXPERIENCE WITH APPLICATION TO FUTURE PAYLOAD DESIGN
Stanley Barrett, W. Paul Rader, and Kenneth R. Payne Jul. 1978 165 p refs
(Contract NAS1-14370)
(NASA-CR-3014; MCR-77-144) Avail: NTIS HC A08/MF A01 CSCL 22B

Analytical and test techniques are discussed. Areas in which hindsight indicated erroneous, redundant, or unnecessarily severe design and test specifications are identified. Recommendations are made for improvements in the dynamic design and criteria philosophy, aimed at reducing costs for payloads. B.B.

N78-32123# Indian Inst. of Science, Bangalore. Dept. of Aeronautical Engineering.
ROCKET STRUCTURES
S. Durvasula *In its* Space Sci., Technol. and Appl.: An Overview Apr. 1978 17 p refs (For primary document see N78-32114 23-12)
Avail: NTIS HC A10/MF A01

N78-32126# Indian Space Research Organization, Bangalore. Satellite Center.
ELEMENTS OF SPACECRAFT DESIGN
K. Kasturirangan *In* Indian Inst. of Sci. Space Sci., Technol. and Appl.: An Overview Apr. 1978 7 p (For primary document see N78-32114 23-12)
Avail: NTIS HC A10/MF A01

N78-32127# Indian Space Research Organization, Bangalore. Satellite Center.
SPACECRAFT MECHANICAL SYSTEMS
A. V. Patki *In* Indian Inst. of Sci. Space Sci., Technol. and Appl.: An Overview Apr. 1978 10 p (For primary document see N78-32114 23-12)
Avail: NTIS HC A10/MF A01

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N78-32129# Indian Space Research Organization, Bangalore. Satellite Center.
SENSORS FOR SPACE
T. K. Alex *In* Indian Inst. of Sci. Space Sci., Technol. and Appl.: An Overview Apr. 1978 9 p (For primary document see N78-32114 23-12)
Avail: NTIS HC A10/MF A01

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N78-32179* National Aeronautics and Space Administration. Pasadena Office, Calif.
SOLID PROPELLANT MOTOR Patent
John I. Shafer (JPL) and Harold E. Marsh, Jr., inventors (to NASA) (JPL) Issued 26 Sep. 1978 8 p Filed 13 May 1970 Sponsored by NASA
(NASA-Case-NPO-11458A; US-Patent-4,116,131; US-Patent-Appl-SN-48621; US-Patent-Class-102-103; US-Patent-Class-149-19.4; US-Patent-Class-149-42; US-Patent-Class-149-43; US-Patent-Class-149-44; US-Patent-Class-149-76; US-Patent-Class-149-83; US-Patent-Class-149-85) Avail: US Patent Office CSCL 21H

A case bonded end burning solid propellant rocket motor is described. A propellant with sufficiently low modulus to avoid chamber buckling on cooling from cure and sufficiently high elongation to sustain the stresses induced without cracking is used. The propellant is zone cured within the motor case at high pressures equal to or approaching the pressure at which the motor will operate during combustion. A solid propellant motor with a burning time long enough that its spacecraft would be limited to a maximum acceleration of less than 1 g is provided by one version of the case bonded end burning solid propellant motor of the invention. Official Gazette of the U.S. Patent Office

N78-32180*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
IMPINGEMENT EFFECT OF SERVICE MODULE REACTION CONTROL SYSTEM ENGINE PLUMES. RESULTS OF SERVICE MODULE REACTION CONTROL SYSTEM PLUME MODEL FORCE FIELD APPLICATION TO AN INFLIGHT SKYLAB MISSION PROXIMITY OPERATION SITUATION WITH THE INFLIGHT SKYLAB RESPONSE
John D. Lobb, Jr. Apr. 1978 34 p refs
(NASA-TM-79741; JSC-13965) Avail: NTIS HC A03/MF A01 CSCL 21H

Plume impingement effects of the service module reaction control system thruster firings were studied to determine if previous flight experience would support the current plume impingement model for the orbiter reaction control system engines. The orbiter reaction control system is used for rotational and translational maneuvers such as those required during rendezvous, braking, docking, and station keeping. Therefore, an understanding of the characteristics and effects of the plume force fields generated by the reaction control system thruster firings were examined to develop the procedures for orbiter/payload proximity operations. B.B.

N78-32181*# Rocketdyne, Canoga Park, Calif.
TRIPROPELLANT ENGINE STUDY Final Report, Aug. 1977 - May 1978
D. B. Wheeler and F. M. Kirby Sep. 1978 146 p refs (Contract NAS8-32513)
(NASA-CR-150803; RI/RD78-215) Avail: NTIS HC A07/MF A01 CSCL 21H

The potential for converting the space shuttle main engine (SSME) to a dual-fuel, dual-mode engine using LOX/hydrocarbon propellants in mode 1 and LOX/H2 in mode 2 was examined. Various engine system concepts were formulated that included staged combustion and gas generator turbine power cycles, and LOX/RP-1, LOX/CH4, and LOX/C3H8 mode 1 propellants. Both oxidizer and fuel regenerative cooling were considered. All of the SSME major components were examined to determine their adaptability to the candidate dual-fuel engines. J.M.S.

N78-32182# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
ANALYTIC INVESTIGATION OF MULTINOZZLE PLUME FLOW FIELDS Interim Report, 1 Oct. 1976 - 30 Sep. 1977
Stanley Rudman Jan. 1978 22 p refs
(Contract F44620-76-C-0021)
(AD-A055395; AFOSR-78-0604TR) Avail: NTIS HC A02/MF A01 CSCL 20/4

Progress on the research effort 'Analytic Investigation of Multinozzle Plume Flow Fields' includes major achievements such as the development of numerical techniques and a computer code for calculation of the impingement of two rectangular plumes, and a parametric study indicating that near field shock heating due to multiple nozzle flow field impingement can explain experimental data. Author (GRA)

N78-32121# Indian Space Research Organization, Bangalore. Satellite Center.
ELEMENTS OF ROCKET SYSTEM DESIGN FOR SPACE RESEARCH
R. M. Vasagam *In* Indian Inst. of Sci. Space Sci., Technol. and Appl.: An Overview Apr. 1978 6 p (For primary document see N78-32114 23-12)
Avail: NTIS HC A10/MF A01

N78-32122# Indian Inst. of Science, Bangalore. Dept. of Aeronautical Engineering.
ROCKET PROPULSION
H. S. Mukunda *In its* Space Sci., Technol. and Appl.: An Overiew Apr. 1978 20 p refs (For primary document see N78-32114 23-12)
Avail: NTIS HC A10/MF A01

N78-32131# Indian Space Research Organization, Bangalore. Satellite Center.
SPACECRAFT POWER SYSTEMS
R. Ashiya *In* Indian Inst. of Sci. Space Sci., Technol. and Appl.: An Overview Apr. 1978 7 p refs (For primary document see N78-32114 23-12)
Avail: NTIS HC A10/MF A01

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

No abstracts in this category.

24 COMPOSITE MATERIALS

Includes laminates.

N78-32183 Old Dominion Univ., Norfolk, Va.
CRACK PROPAGATION IN ALUMINUM SHEETS REINFORCED WITH BORON-EPOXY Ph.D. Thesis
George Lawrence Roderick 1978 247 p
Avail: Univ. Microfilms Order No. 7813916

An analysis was developed to predict both the crack growth and debond growth in a reinforced system. The analysis was based on the use of complex variable Green's functions for cracked, isotropic sheets and uncracked, orthotropic sheets to calculate inplane and interlaminar stresses, stress intensities, and strain-energy-release rates. An iterative solution was developed that used the stress intensities and strain-energy-release rates to predict crack and debond growths, respectively, on a cycle-by-cycle basis. The analysis was verified with experiments. The analysis was used in a parametric study of the effects of boron-epoxy composite reinforcement on crack propagation in aluminum sheets. It is shown that the size of the debond area has a significant effect on the crack propagation in the aluminum. Dissert. Abstr.

N78-32184 Old Dominion Univ., Norfolk, Va.
ANALYSIS OF MOISTURE ABSORPTION AND DIFFUSION IN FIBER REINFORCED POLYMERIC RESIN-MATRIX COMPOSITE MATERIALS Ph.D. Thesis
Stephen Stern Topkins 1978 120 p
Avail: Univ. Microfilms Order No. 7813917

The diffusion of moisture through fiber reinforced polymeric-matrix composite materials was studied analytically. The diffusion in the orthotropic, nonhomogeneous material was modeled, in detail, with a two-dimensional transient diffusion analysis. An effective diffusivity for the composite was determined in terms of the fiber volume fraction and the resin diffusivity. The influence of both material and environmental parameters on the moisture content of the composite was determined analytically. Predicted moisture contents were compared over a wide range of values for emittance, solar absorptance, convective heat-transfer coefficient, ambient temperature, solar radiation, and panel orientation with respect to the sun and geographical location. The calculations showed that absorptance and the heat-transfer coefficient have significant effects on the moisture content. The equilibrium moisture content is relatively insensitive to the geographical location for areas with similar humid environments. Dissert. Abstr.

N78-32185*# Boeing Commercial Airplane Co., Seattle, Wash.
ADVANCED COMPOSITES WING STUDY PROGRAM. VOLUME 1: EXECUTIVE SUMMARY Final Report
Stanley T. Harvey and Gary L. Michaelson Sep. 1978 18 p 2 Vol.
(Contract NAS1-15003)
(NASA-CR-145382-1) Avail: NTIS HC A02/MF A01 CSCL 11D

The effort necessary to achieve a state of production readiness for the design and manufacturing of advanced composite wing structure is outlined. Technical assessment and program options are also reviewed for the wing study results. J.A.M.

N78-32186*# Boeing Commercial Airplane Co., Seattle, Wash.
ADVANCED COMPOSITES WING STUDY PROGRAM. VOLUME 2 Final Report
Stanley T. Harvey and Gary L. Michaelson 1 Aug. 1978 119 p 2 Vol.
(Contract NAS1-15003)
(NASA-CR-145382-2) Avail: NTIS HC A06/MF A01 CSCL 11D

The study on utilization of advanced composites in commercial aircraft wing structures was conducted as a part of the NASA Aircraft Energy Efficiency Program to establish, by the mid-1980s, the technology for the design of a subsonic commercial transport aircraft leading to a 40% fuel savings. The study objective was to develop a plan to define the effort needed to support a production commitment for the extensive use of composite materials in wings of new generation aircraft that will enter service in the 1985-1990 time period. Identification and analysis of what was needed to meet the above plan requirements resulted in a program plan consisting of three key development areas: (1) technology development; (2) production capability development; and (3) integration and validation by designing, building, and testing major development hardware. J.A.M.

N78-32187*# Lockheed-California Co., Burbank.
STUDY ON UTILIZATION OF ADVANCED COMPOSITES IN COMMERCIAL AIRCRAFT WING STRUCTURES. VOLUME 1: EXECUTIVE SUMMARY Final Report
I. Frank Sakata, Robert B. Ostrom, and Sal V. Cardinale Aug. 1978 23 p ref 2 Vol.
(Contract NAS1-28611)
(NASA-CR-145381-1; LR-28611-Vol-1) Avail: NTIS HC A02/MF A01 CSCL 11D

The effort required by commercial transport manufacturers to accomplish the transition from current construction materials and practices to extensive use of composites in aircraft wings was investigated. The engineering and manufacturing disciplines which normally participate in the design, development, and production of an aircraft were employed to ensure that all of the factors that would enter a decision to commit to production of a composite wing structure were addressed. A conceptual design of an advanced technology reduced energy aircraft provided the framework for identifying and investigating unique design aspects. A plan development effort defined the essential technology needs and formulated approaches for effecting the required wing development. The wing development program plans, resource needs, and recommendations are summarized. J.M.S.

N78-32188*# Lockheed-California Co., Burbank.
STUDY ON UTILIZATION OF ADVANCED COMPOSITES IN COMMERCIAL AIRCRAFT WING STRUCTURES, VOLUME 2 Final Report
I. Frank Sakata and Robert B. Ostrom Aug. 1978 242 p refs 2 Vol.
(Contract NAS1-15005)
(NASA-CR-145381-2; LR-28610-Vol-2) Avail: NTIS HC A11/MF A01 CSCL 11D

A plan is defined for a composite wing development effort which will assist commercial transport manufacturers in reaching a level of technology readiness where the utilization of composite wing structure is a cost competitive option for a new aircraft production plan. The recommended development effort consists of two programs: a joint government/industry material development program and a wing structure development program. Both programs are described in detail. J.M.S.

N78-32189*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FIBROUS REFRACTORY COMPOSITE INSULATION Patent Application
Daniel B. Leiser (Stanford Univ.), Howard E. Goldstein, and Marnell Smith, inventors (to NASA) Filed 8 Sep. 1978 17 p
(NASA-Case-ARC-11169-1; US-Patent-Appl-SN-940688) Avail: NTIS HC A02/MF A01 CSCL 11D

A high temperature insulating material suitable for reusable reentry heat shielding was prepared from silica fibers and aluminosilicate fibers in a weight ratio ranging from 1:19 to 19:1, and about 0.5% to 30% boron oxide, based on the total fiber weight. Aluminoborosilicate fibers and additional free boron oxide, up to the 30% limit, may be substituted for the aluminosilicate fibers and boron oxide requirements. Small quantities of refractory opacifiers, such as silicon carbide, may be added. The composites are characterized by the absence of nonfibrous matrix. NASA

N78-32190*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
CORK-RESIN ABLATIVE INSULATION FOR COMPLEX SURFACES AND METHOD FOR APPLYING THE SAME Patent Application
Hill M. Walker, Max H. Sharpe, inventors (to NASA), and William G. Simpson Filed 17 Oct. 1978 10 p
(NASA-Case-MFS-23626-1; US-Patent-Appl-SN-941711) Avail: NTIS HC A02/MF A01 CSCL 11D

An ablative insulation material is made from a B-stage curable thermosetting resin and finely divided cork. Cork and the selected resin such as a phenolic resin are mixed, formed into a block and cured to B-stage. The B-stage cured block is sliced into sheets and the sheets are laid up on the surface being insulated. Final curing of the resin is then performed. By using B-stage cured cork-resin sheets, rather than fully cured sheets to the insulated surface, problems associated with lack of flexibility in fully cured sheets are avoided, and application to complex surfaces is facilitated. Improved ablation performance, lower density and higher strength are also obtained. NASA

N78-32191*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF MOISTURE PROFILES AND LAMINATE CONFIGURATION ON THE HYGRO STRESSES IN ADVANCED COMPOSITES
C. C. Chamis, J. H. Sinclair, and R. F. Lark 1978 16 p ref Presented at the 10th Natl. Tech. Conf., Kiameshe Lake, New York, 17-19 Oct. 1978 Sponsored by the Soc. for the Advan. of Mater. and Process Eng.
(NASA-TM-78978; E-9755) Avail: NTIS HC A02/MF A01 CSCL 11D

An integrated hygrothermo-mechanical theory was used to predict the effects of three moisture profiles on the ply hygro stresses in angleplied laminates. The moisture profiles were linear, parabolic and hyperbolic. Moisture content varied from 1 percent in the exposed ply to zero in the protected ply. The angleplied laminates were of two generic configurations. The results obtained are summarized graphically to illustrate the effects of both moisture profile and laminate configuration. The results indicate that ply transverse tensile hygro stresses may reach sufficiently high magnitudes to cause transply cracking. A.R.H.

N78-32192# Aeronautical Research Associates of Princeton, Inc., N. J.
A NEW FINITE ELEMENT TECHNIQUE AND A STUDY OF RESIDUAL STRESS IN COMPOSITE MATERIALS Final Report, 15 June 1976 - 30 Nov. 1977
Thomas B. McDonough Apr. 1978 70 p refs
(Contract F44620-76-C-0122; AF Proj. 2307)
(AD-A054786; ARAP-336; AFOSR-78-0957TR) Avail: NTIS HC A04/MF A01 CSCL 11/4

Two studies are presented in this report. The first is the development of a new finite element solution, and the second is an analysis of residual stress in filamentary composite material. The new feature of the finite element solution is in the formulation phase of the development; existing procedures are used for the numerical solution. The technique presented is restricted to problems usually described as quasistatic or creeping flow, but it is not restricted by small strain or rotation, nor is it specialized to a particular theory of constitutive behavior. Relative to existing codes the new technique may offer advantages for the study of solid-fluid interactions or for material behavior which fits neither of the concepts of solids or fluids. Four sample problems are studied. A comparison of numerical predictions with some exact analytic solutions is presented, and the comparison is excellent. The second study concerns residual stress. Its development in polymeric filamentary reinforced composite materials is discussed in terms of differential dimensional changes that occur during processing. Two phenomena which contribute to the development of residual stress are considered: dimensional change of the resin due to polymerization and differential thermal expansion of the resin and reinforcement upon cooling from the cure temperature to room temperature. Results of the study to date do not indicate that dimensional changes due to polymerization may be neglected in residual stress assessments. Author (GRA)

N78-32193# Illinois Univ. at Chicago Circle, Chicago. Dept. of Materials Engineering.
A REVIEW OF DYNAMIC RESPONSE OF COMPOSITES Final Report, 1 Jul. 1975 - 31 Dec. 1976
T. C. T. Lee Apr. 1978 142 p refs
(Contract DAAG46-75-C-0090)
(AD-A055739; AMMRC-TR-78-20) Avail: NTIS HC A07/MF A01 CSCL 11/4

The purpose of this project was to review the state of the art on the dynamic response of composites and to suggest possible future research directions. More than three hundred papers are reviewed and compiled at the end of this report. The existing theories of the dynamic response of composites are summarized in Chapter 1. The harmonic waves and transient waves in, and the experiments on, composites are discussed in Chapters 2, 3 and 4, respectively. The differences between various theories and possible future research directions are presented in Chapter 5. Author (GRA)

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry, and photochemistry

For related information see also *77 Thermodynamics and Statistical Physics*.

N78-32194 Purdue Univ., Lafayette, Ind.
STUDIES OF SOLUTION STRUCTURE BY MOLECULAR SPECTROSCOPY Ph.D. Thesis
Shankar Shivaram Hegde 1977 268 p
Avail: Univ. Microfilms Order No. 7813070

Information about the nature of the environment of the Co-(CO)-(4) ion was obtained from a study of the infrared band in the 5 micronregion due to the C-O stretch of NaCo (CO)4 in M-pyrol, oxetane, DME, THF THP and MTHF. The method depends upon the spectral resolution and accuracy of the measurement of the contour of the overlapped band and upon the use of an analytic expression for the representation of a single band. Improvements in recording the spectral contours over a wide range of temperature, coupled with a mathematical model to represent the single band enabled to characterize five different structurites for the Co(CO)-(4) anion in these electrolytic nonaqueous solutions were characterized. Dissert. Abstr.

N78-32195 Tulsa Univ., Okla.
A THEORETICAL INVESTIGATION OF FORWARD COMBUSTION IN A ONE DIMENSIONAL SYSTEM Ph.D. Thesis
Vidya Bhushan Verma 1978 113 p
Avail: Univ. Microfilms Order No. 7812311

A mathematical model is presented that incorporates the principal kinetic, thermal, thermodynamic and hydrodynamic aspects of the process. The model treats seven equations, and accounts for a mass balance on fuel, which incorporates both fuel laydown and burnoff. Vaporization-condensation of both oil and water is included. The model yields spatial distributions of pressure, temperature, oil, water, gas, and fuel saturations and/or concentrations. A detailed interpretation of the various computed profiles is presented. Some phenomena (e.g., the existence of an oil vapor plateau, peak shaving of the water vapor profiles, etc.) not previously identified are given. Comparisons of the computed results with laboratory experimental results are also presented. Dissert. Abstr.

N78-32196 California Univ., Berkeley.
LEAN LIMIT COMBUSTION IN AN EXPANDING CHAMBER Ph.D. Thesis
Owen Irby Smith 1977 140 p
Avail: Univ. Microfilms Order No. 78-12782

The propagation of methane-air flames in an enclosure designed to simulate conditions encountered in an internal combustion engine was investigated. As the lean flammability limit is approached, the typical automotive engine exhibits an increase in unburned hydrocarbon emissions along with an increase in specific fuel consumption which is characteristic of incomplete combustion. Emphasis was placed on experimental conditions where incomplete combustion in the bulk gas (as opposed to the thermal boundary layer) due to quenching of hydrocarbon oxidation reactions by volume expansion was observed. Cases involving flame propagation in a constant volume chamber, an expanding chamber, and a chamber subjected to a compression-expansion sequence were investigated. The amount of volume expansion is found to be directly related to the occurrence of bulk quenching, while the rate of volume expansion is not. Dissert. Abstr.

N78-32197*# National Aeronautics and Space Administration, Washington, D. C.
THE THERMAL POWER OF ALUMINUM NITRIDE AT TEMPERATURES BETWEEN 1350 AND 1650 DEG C IN ARGON AND NITROGEN ATMOSPHERES Ph.D. Thesis - Rhine-Westphalia High School at Aachen
W. A. Fischer and Bernd Schuh Aug. 1978 12 p refs Transl. into ENGLISH from Eisenhuettenwes (West Germany), v. 45,

no. 7, Dec. 1974 p 839-842 Lecture presented at a session of the Subcommittee for Phys. Chem., Duesseldorf, 29 Mar. 1974 Transl. by SCITRAN, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75441) Avail: NTIS HC A02/MF A01 CSCL 07D

The test apparatus for measuring the thermal voltage of aluminum nitride for temperature differences of up to + or - 60 C between 1350 and 1650 C is described. The thermal power and its homogeneous proportion are determined and the heat transfer of the migration ions resulting from the homogeneous thermal power is calculated. The conduction mechanism in aluminum nitride is discussed. J.M.S.

N78-32198*# National Aeronautics and Space Administration, Washington, D. C.
CONDUCTIVITY OF MATERIALS MADE OF ALUMINUM NITRIDE AND SILICON NITRIDE MIXTURES
A. G. Gorbatov and V. M. Kamyshov Aug. 1978 9 p refs Transl. into ENGLISH from Porosh. Met. (USSR), no. 11 (95), Nov. 1970 p 61-65 Transl. by Sci. Transl. Serv., Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75327) Avail: NTIS HC A02/MF A01 CSCL 07D

To establish the possible mechanism for conductivity in aluminum nitride a study was made of the electric conductivity of pure AlN and its mixtures with silicon nitride at different temperatures and partial pressures of nitrogen in the gas phase. The thermoelectromotive force was also measured. The experiments used polycrystalline samples of cylindrical shape 18 mm in diameter made of powders by hot pressing in graphite press molds at a temperature of 1973-2273 K and pressure 1,470,000 n/sqm. The items obtained by this method had porosity not over 5%. After pressing, the samples were machined to remove carbon from the surface, and were annealed in a stream of dry ammonia for 10 h at a temperature of 1273-1373 K. Electric conductivity was measured according to the bridge scheme on an alternating current of frequency 10 kHz. In order to guarantee close contact of the platinum electrodes with the surface of the samples, a thin layer of platinum was sprayed on them. Experiments were conducted in the temperature interval 1273-1573 K with a half hour delay at each assigned temperature with heating and cooling. G.Y.

N78-32199# National Bureau of Standards, Washington, D. C. Center for Fire Research.
IGNITION OF A LIQUID FUEL UNDER HIGH INTENSITY RADIATION Interim Report, 1 May 1977 - 30 Apr. 1978
Takashi Kashiwagi and Howard R. Baum 1978 33 p refs
(AFOSR-ISSA-77-0016; AF Proj. 2308)
(AD-A054974; AFOSR-78-1008TR) Avail: NTIS HC A03/MF A01 CSCL 21/4

Laser technology has been rapidly advancing in the last two decades. Power outputs of modern lasers increased significantly and these lasers can be used as tactical weapons. A high power laser weapon can ignite aircraft fuel through fuel tank penetration and can cause fire or explosion of the aircraft. The objective of this program is to obtain a fundamental understanding of physical and chemical mechanism of the ignition of liquid fuels under high intensity radiation. The program consists of an experimental study to clarify the key mechanisms of ignition, and a theoretical study to predict the qualitative effects of physical and chemical parameters on ignition of flammable liquids. Since the radiative ignition of flammable liquids is hardly known, the theoretical study has been deferred until the key ignition process is confirmed from the experimental study. GRA

N78-32200# Ohio State Univ. Research Foundation, Columbus. Dept. of Aeronautical and Astronautical Engineering.
IGNITION, COMBUSTION, DETONATION, AND QUENCHING OF REACTIVE MIXTURES Interim Report, 1 Apr. 1976 - 31 Mar. 1977
Rudolph Edse and Om Dhiman Dec. 1977 80 p refs
(Grant AF-AFOSR-2511-73; AF Proj. 2308)
(AD-A054787; OSURF-760100/783641; AFOSR-78-0956TR) Avail: NTIS HC A05/MF A01 CSCL 21/2

A one mole hydrogen - one mole bromine mixture has been detonated by shock ignition. To distinguish the shock wave driven into the hydrogen-bromine mixture from a detonation wave which may have formed, the measured wave speeds and pressures were compared with theoretically calculated values. The experimental data were found to be nearly equal to those of the C.J. detonation wave. Calculations of the reaction zone thickness of the wave show that the straight chain reaction mechanism for the hydrogen bromide formation can sustain stable detonation waves. Several series of experiments to quench flames of various gaseous fuel-air mixtures were carried out with three different flame arrestors. The most useful device is a rectangular burner with a large length-to-width ratio. The bunsen type flames were quenched by squeezing them between two movable blocks, which were made from different materials and coated with catalysts and inhibitors. The steady-state condition of various phases of the quenching process, which this device can produce, has made spectroscopic studies possible. These observations revealed that nonequilibrium states are formed during the quenching process. GRA

N78-32201# Purdue Univ., Lafayette, Ind.
EXPERIMENTAL AND THEORETICAL STUDIES OF CHEMICAL DYNAMICS AND INSTABILITIES IN IRREVERSIBLE PROCESSES
John Ross and F. G. Keyes May 1978 19 p refs Prepared in cooperation with MIT, Cambridge
(Contract N00014-75-C-1143; Proj. SQUID)
(AD-A055939; SQUID-TR-MIT-89-PU) Avail: NTIS HC A02/MF A01 CSCL 07/4

The final report summarizes the work accomplished under the subcontract. The overall objectives of the investigation were as follows: the determination of molecular properties of chemical dynamics for reactions of importance to combustion and propulsion, molecular beam techniques were used for the experimental part of this work and were accompanied by theoretical studies in chemical dynamics. The second purpose was the study of the interaction of chemical reactions with transport processes and flows in gases in which instabilities may occur. Author (GRA)

N78-32202# Instituto Nacional de Tecnica Aeroespacial, Madrid (Spain).
UNSTEADY BURNING OF SOLID PROPELLANTS Final Report, 1 Jul. 1976 - 30 Sep. 1977
A. Crespo and M. Kindelan Apr. 1978 54 p refs
(Grant AF-AFOSR-3049-76)
(AD-A055948; AFOSR-78-1104TR) Avail: NTIS HC A04/MF A01 CSCL 21/9

A theoretical analysis is presented of unsteady solid propellant combustion, particularly combustion stability and extinction by rapid depressurization. It is assumed that the solid decomposes by a pyrolosis law and the gaseous products react exothermically following an Arrhenius law. For large values of this non-dimensional activation energy the gas-phase combustion, turns out to be quasisteady. The characteristic response time of the solid to gas-phase perturbations turns out to be large compared to the characteristic residence time in the heat-up zone of the solid, their ratio being of the order of the non-dimensional activation energy in the gas-phase. A linear stability criterion has been obtained that gives stable burning for steady burning rates above and below two limiting values; the width of the unstable region increases with the activation energy of the pyrolisis law, and becomes zero for a finite value of that activation energy. GRA

N78-32203# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Aerospace and Ocean Engineering.
IGNITION OF LIQUID FUELS IN SUPERSONIC AIR STREAMS Interim Scientific Report, 1 Dec. 1977 - 31 Oct. 1978
Joseph A. Schetz and Steven C. Cannon May 1978 80 p refs
(Grant AF-AFOSR-3485-78)
(AD-A055951; VPI/SU-AERO-082; AFOSR-78-1098TR) Avail: NTIS HC A05/MF A01 CSCL 21/2

An experimental study of the ignition of liquid fuels injected transverse to red were kerosene, CS2 and water as an inert control. The major variables were air stagnation temperature in the range 1500 to 2300 F, injectant flow rate and injection angles from 90 to 45 deg upstream. The experimental observa-

tions were temperature measurements on the wall near the injector and in the flow downstream on injection, self-luminosity photographs and infrared photographs taken with a thermographic camera. Special attention was directed at the behavior of the liquid layer that had previously been found to form near the injector. No unequivocal evidence of ignition of either fuel was found for normal injection at these conditions. However, clear evidence of ignition of CS2 was found for the upstream injection angle for T sub O or 2030 F and 80 or P sub j or 135 psi. High injection pressures and thus high flow rates failed to produce ignition at any temperature tested. Evidence of CS2 ingnition was found in the infrared photographs and wall and in stream temperature measurements simultaneously. The infrared photographs indicated possible ignition of the kerosene for upstream injection, but this could not be corroborated with the temperature measurements. Author

N78-32204# SRI International Corp., Menlo Park, Calif.
SURFACE STATES ASSOCIATED WITH CHEMISORBED SPECIES Final Report, 15 Mar. 1975 - 15 Mar. 1978
S. Roy Morrison May 1978 6 p
(Contracts DAAG29-75-C-0017; DAHC04-75-C-0017)
(AD-A055446; ARO-12925.2-C) Avail: NTIS HC A02/MF A01 CSCL 11/2

Two areas of interest were investigated, first, surface states on semiconducting powders, and second, states associated with defects in passivating oxide films, emphasizing SiO2 on Si. Author (GRA)

N78-32205# Dow Chemical Co., Midland, Mich.
EVALUATION AND COMPILATION OF THERMODYNAMIC PROPERTIES OF HIGH TEMPERATURE CHEMICAL SPECIES Final Report, 1 Jan. 1975 - 31 Dec. 1977
M. W. Chase 31 Mar. 1978 12 p refs
(Contract F44620-75-C-0048)
(AD-A055660; AFOSR-78-1060TR) Avail: NTIS HC A02/MF A01 CSCL 07/4

This work involves a continuing effort to provide a set of critically evaluated, internally consistent, high temperature thermochemical tables: the JANAF Thermochemical Tables. In this three year contract period 147 revised and 152 new thermochemical tables were issued. A portion of these tables resulted from a concurrent Department of Energy contract. This brings the total number of JANAF Thermochemical Tables to 1449. GRA

N78-32206# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
ALKALI-SILICA REACTION PRODUCTS FROM SEVERAL CONCRETES: OPTICAL, CHEMICAL, AND X-RAY DIFFRACTION DATA Final Report
Alan D. Buck and Katharine Mather May 1978 18 p refs
(AD-A055742; WES-MP-C-78-7) Avail: NTIS HC A02/MF A01 CSCL 11/2

Alkali-silica reaction products from six different concretes were examined by X-ray diffraction and light microscope, and four of the gels were chemically analyzed. Most of the reaction products were crystalline in considerable part and were composed of one or more of four phases. Two of the phases were tentatively identified as variants on CSH(I) and CSH(II). Author (GRA)

N78-32207# Ballistic Research Labs., Aberdeen Proving Ground, Md.
SUMMARY OF PHOTODESTRUCTION CROSS SECTION MEASUREMENTS OF ATMOSPHERIC IONS
John A. Vanderhoff May 1978 38 p refs
(AD-A056367; AD-E430066; ARBRL-TR-02070) Avail: NTIS HC A03/MF A01 CSCL 07/4

Using a drift tube mass spectrometer coupled with a laser photon source, absolute photodestruction cross sections as a function of photon energy have been measured for various room temperature (300 K) atmospheric ions. These ions are O2(-), O3(-), O4(-), NO2(-), SO2(-), O2(-)(H2O), CO4(-), SO4(-), O2(+)(O2), O2(+) (H2O), O2(+)(CO2), O2(+) (SO2), CO2(+) (CO2), and H(+)(H2O) n-1 to 4. Author (GRA)

N78-32208# California Univ., Berkeley. Lawrence Berkeley Lab.
WAVELENGTH MODULATION SPECTROSCOPY OF SEMICONDUCTORS M.S. Thesis
Stanley Erwin Kohn Oct. 1977 111 p refs
(Contract W-7405-eng-48)
(LBL-6919) Avail: NTIS HC A06/MF A01

The use of modulation spectroscopy to study the electronic properties of solids was very productive. The construction of a wide range Wavelength Modulation Spectrometer to study the optical properties of solids is described in detail. Extensions of the working range of the spectrometer into the vacuum ultraviolet are discussed. Measurements of the reflectivity and derivative reflectivity spectra of the lead chalcogenides, the chalcopyrite ZnGeP2, the layer compounds GaSe and GaS and their alloys, the ferroelectric SbSI, layer compounds SnS2 and SnSe2, and HfS2 were made. The results of these measurements are presented along with their interpretation in terms of band structure calculations. ERA

N78-32209# Hebrew Univ., Jerusalem (Israel). Dept. of Physical Chemistry.
ACTION OF RADIATIONS OF SOME BIOLOGICAL MODEL SYSTEMS
G. Czapski Jun. 1977 7 p
(Contract EY-76-C-02-3009)
(COO-3009-28) Avail: NTIS HC A02/MF A01

Investigations of primary photochemical processes under conditions of pulsed high activation intensity pulsed lasers are summarized as well as pulse radiolysis studies of the inactivation of ribonuclease by redox reactions and the redox mechanism of cytochrome C. Publications resulting from these studies are cited. ERA

N78-32210# Informatics, Inc., Rockville, Md.
MONOGRAPH ON CARBON (ACTIVATED CHARCOAL) Final Report, 1920 - 1977
Robert W. Rogers 18 Oct. 1977 41 p refs
(Contract FDA-223-76-2001)
(PB-280129/8; FDA/BF-78/90) Avail: NTIS HC A03/MF A01 CSCL 02D

This bibliography contains 141 references. The available scientific literature from 1920 to 1977 related to the safety of carbon (activated charcoal) is summarized. Chemical information, biological data, and biochemical aspects of this compound are given. GRA

N78-32211# National Technical Information Service, Springfield, Va.
ACTIVATED CARBON, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1975 - Jun. 1978
Diane M. Cavagnaro Jun. 1978 202 p Supersedes NTIS/PS-77/0536; NTIS/PS-76/0479 and NTIS/PS-75/461 6 Vol.
(NTIS/PS-78/0624/3; NTIS/PS-77/0536; NTIS/PS-76/0479; NTIS/PS-75/461) Avail: NTIS HC $28.00/MF $28.00 CSCL 07A

A bibliography containing 194 abstracts concerning sewage and industrial waste water treatment using activated carbon is presented. These were separated from other uses of activated carbon. Both laboratory and engineering studies were reviewed. Reports on activated carbon are presented including research on its properties and its use in air pollution control, gas and water analysis, the absorption of chemicals and radioactive isotopes especially iodine isotopes, and drinking water treatment. GRA

N78-32212# National Technical Information Service, Springfield, Va.
ACTIVATED CARBON, VOLUME 1, PART 1: WASTE WATER TREATMENT. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - 1975
Diane M. Cavagnaro Jun. 1978 160 p 6 Vol.
(NTIS/PS-78/0625/0) Avail: NTIS HC $28.00/MF $28.00 CSCL 07A

A bibliography containing 153 abstracts concerning studies on activated carbon as it is used in treating industrial and sewage wastes is presented. The process description, economics, mathematical models, performance and the property changes the carbon undergoes is discussed. GRA

N78-32213# National Technical Information Service, Springfield, Va.
ACTIVATED CARBON. VOLUME 2, PART 1: WASTE WATER TREATMENT. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1976 - Jun. 1978
Diane M. Cavagnaro Jun. 1978 163 p Supersedes NTIS/PS-77/0537 and NTIS/PS-76/0480 6 Vol.
(NTIS/PS-78/0626/8; NTIS/PS-77/0537; NTIS/PS-76/0480) Avail: NTIS HC $28.00/MF $28.00 CSCL 07A

A bibliography containing 156 abstracts concerning activated carbon as it is used in treating industrial and sewage wastes, relative to process description, economics, mathematical models, performance, and the property changes the carbon undergoes is presented. GRA

N78-32214# National Technical Information Service, Springfield, Va.
ACTIVATED CARBON. VOLUME 1, PART 2: OTHER USES. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - 1975
Diane M. Cavagnaro Jun. 1978 192 p 6 Vol.
(NTIS/PS-78/0627/6) Avail: NTIS HC $28.00/MF $28.00 CSCL 07A

A bibliography containing 185 abstracts concerning the use of activated carbon in air pollution, textile processing, absorption of chemicals and radioactive isotopes, drinking water treatment, the mining industry, electrochemistry, and the change its properties undergo is presented. GRA

N78-32215# National Technical Information Service, Springfield, Va.
ACTIVATED CARBON. VOLUME 2, PART 2: OTHER USES. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1976 - Jun. 1978
Diane M. Cavagnaro Jun. 1978 167 p Supersedes NTIS/PS-77/0538 and NTIS/PS-76/0481
(NTIS/PS-78/0628/4; NTIS/PS-77/0538; NTIS/PS-76/0481) Avail: NTIS HC $28.00/MF $28.00 CSCL 07A

A bibliography containing 160 abstracts concerning the uses of activated carbon other than industrial waste treatment is presented. Activated carbon in air pollution, textiles processing, absorption of chemicals and radioactive isotopes, drinking water treatment, the mining industry, and electrochemistry is studied. GRA

N78-32216# National Technical Information Service, Springfield, Va.
ACTIVATED CHARCOAL. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - 1978
Diane M. Cavagnaro Jun. 1978 83 p Supersedes NTIS/PS-77/0539 and NTIS/PS-76/0493 6 Vol.
(NTIS/PS-78/0629/2; NTIS/PS-77/0539; NTIS/PS-76/0493) Avail: NTIS HC $28.00/MF $28.00 CSCL 07A

A bibliography containing 76 abstracts concerning the uses of activated charcoal in industry as well as in the laboratory, including its use in air pollution, chemical adsorption, radioactive waste adsorption, electrochemistry, industrial waste treatment and the mining industry is presented. GRA

N78-32217# National Technical Information Service, Springfield, Va.
SULFUR DIOXIDE CONTROL, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1973 - 1976
Diane M. Cavagnaro Jul. 1978 225 p
(NTIS/PS-78/0653/2) Avail: NTIS HC $28.00/MF $28.00 CSCL 07A

A bibliography of Federally funded research covering air pollution control technology and equipment for sulfur dioxide is presented. They do not cover fuel desulfurization or the use of low sulfur fuels. References do include emission reduction, involving fluidized bed combustion, combustion modification and additives, scrubbing and other flue gas desuldurization processes. GRA

N78-32218# National Technical Information Service, Springfield, Va.
SULFUR DIOXIDE CONTROL, VOLUME 3. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1977 - Jun. 1978
Diane M. Cavagnaro Jul. 1978 150 p Supersedes NTIS/PS-77/0568; NTIS/PS-76/0519; NTIS/PS-75/455; COM-73-11804 (NTIS/PS-78/0654/0; NTIS/PS-77/0568; NTIS/PS-76/0519; NTIS/PS-75/455; COM-73-11804) Avail: NTIS HC $28.00/MF $28.00 CSCL 07A

A bibliography containing 141 abstracts concerning air pollution control technology and equipment for sulfur dioxide is presented. References are included on emissions reduction, involving fluidized bed combustion, combustion modification and additives, scrubbing, and other flue gas desulfurization processes. GRA

N78-32219# National Technical Information Service, Springfield, Va.
SULFUR DIOXIDE CONTROL. CITATIONS FROM THE AMERICAN PETROLEUM INSTITUTE DATA BASE Progress Report, 1976 - Apr. 1978
Diane M. Cavagnaro Jul. 1978 137 p
(NTIS/PS-78/0655/7) Avail: NTIS HC $28.00/MF $28.00 CSCL 07A

This bibliography contains citations on different aspects of air pollution control of sulfur dioxide by industry. Covered are control processes, techniques, equipment, design, and performance. (Contains 130 abstracts) GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N78-32220 Vanderbilt Univ., Nashville, Tenn.
FACTORS INFLUENCING THE DETECTION OF METAL CRACKS BY FLUORESCENT DYE PENETRANTS Ph.D. Thesis
Donald Peter Gregory 1977 134 p
Avail: Univ. Microfilms Order No. 7812417

The crack line intersection, CLI, technique for measuring the sensitivity of fluorescent dye penetrants is developed, and the necessary equipment is designed and fabricated. The crack line intersection technique is then used to first quantitatively rank seven commercial high sensitivity penetrants according to their ability for finding narrow cracks below 0.5 micron in width in mirror finish chrome plated crack steel panels. The data show that to get the best penetrant performance, i.e., highest CLI, within a particular class of penetrants one should maximize fluorescent brightness, kc with limits on concentration, surface tension retaining wettability, viscosity retaining washability and wettability, extinction coefficient, and area under the adsorption-desorption hysteresis loop. Dissert. Abstr.

N78-32221 Iowa State Univ. of Science and Technology, Ames.
EFFECTS OF MINOR ALLOYING ADDITIONS ON THE STRENGTH AND SWELLING BEHAVIOR OF AN AUSTENITIC STAINLESS STEEL Ph.D. Thesis
Gregory Raymond Gessel 1978 210 p
Avail: Univ. Microfilms Order No. 7813225

A set of 32 alloys consisting of various additions of the elements Mo, W, Al, Ti, Nb, C and Si to an Fe-7.5 Cr-20 Ni alloy were made in order to investigate the effects of these solute additions on alloy swelling and strength. Both single and multiple additions were examined. The influence of various solute elements on the swelling behavior in the range 500 to 730 C was investigated using 4 MeV Ni ion bombardment to a dose 170 dpa. A method for treating certain multiple additions is proposed. The effect of these alloying additions on short time high temperature strength properties was estimated using hot hardness measurements over the temperature range 22 to 850 C. An empirical method was devised to estimate the hot hardness of alloys containing more than one solute addition. Dissert. Abstr.

N78-32222 Pittsburgh Univ., Pa.
PRECIPITATION AND COARSENING BEHAVIOR IN TWO COPPER-BASE ALLOYS: COPPER-TITANIA, COPPER CHROMIUM Ph.D. Thesis
Amitava Guha 1977 220 p
Avail: Univ. Microfilms Order No. 7809116

Phase transformations in copper-titania and copper-chromium, were studied in detail, primarily by transmission electron microscopy. In the copper-titania system, an extremely fine dispersion of titanium oxide particles was precipitated by internal oxidation of a Cu-0.25 wt pct Ti alloy. The structure of the oxide particles at high temperatures were determined to be TiO2 of the rutile variety. The degree of coherency of these particles was considered but not completely evaluated. The coarsening behavior of the oxide dispersions was further studied as a function of temperature and two atmospheres of varying partial pressure of oxygen. The agreement between the theory and the experimentally observed values was fair. Dissert. Abstr.

N78-32223 Carnegie-Mellon Univ., Pittsburgh, Pa.
THE KINETICS OF PHASE-LAYER GROWTH DURING THE ALUMINIZATION OF Ni AND Ni-BASE ALLOYS Ph.D. Thesis
Anthony James Hickl 1978 147 p
Avail: Univ. Microfilms Order No. 7812162

The diffusion coating of Ni and binary Ni alloys with Al (aluminization) was studied utilizing a two-step, high-Al activity pack process. The process consisted of an initial influx of Al at the Ni or Ni-alloy surface from a gaseous phase (cementation) and a subsequent partial homogenization of the Al-rich layer under conditions of zero surface flux (conditioning anneal). Mathematical models were used to define the critical parameters controlling kinetics of growth for the aluminide layers formed during this process on unalloyed Ni substrates. The general results of this model were applied to the description of events taking place during the processing of the alloy substrates. The individual alloying elements were determined to change layer growth kinetics by no more than 20%. Dissert. Abstr.

N78-32224 California Univ., Berkeley.
THE DESIGN OF AN Fe-12Mn-0.2Ti ALLOY STEEL FOR LOW TEMPERATURE USE Ph.D. Thesis
Sun-Keun Huang 1977 105 p
Avail: Univ. Microfilms Order No. 7812617

Improving the low temperature mechanical properties of Fe-8 approximately 12 percent Mn-0.2 Ti alloy steels was investigated. A two phase (alpha + gamma) tempering in combination with cold-working or hot-working was identified as an effective treatment. In an Fe-12 Mn-0.2 Ti alloy a promising combination of fracture toughness and yield strength was obtained at -196 C. As a result, a significant reduction of the ductile-brittle transition temperature was obtained in this alloy. The nature and origin of brittle fracture in Fe-Mn alloys were also investigated. This phenomenon was attributed to intergranular tempered martensite embrittlement. Avoiding the embrittling zones by controlled cooling led to a high cryogenic toughness in a solution-annealed condition. Dissert. Abstr.

N78-32225 Notre Dame Univ., Ind.
CRYSTAL DEFECTS AND POLYTYPISM IN TITANIUM-BASE LAVES PHASES Ph.D. Thesis
Kenneth Chau-Kun Liao 1978 122 p
Avail: Univ. Microfilms Order No. 7812899

The relationship between crystal defects, polytypism and phase transformation in Ti-base Laves phases TiCO(2+x) and TiCr(2+x) were studied by electron microscopy and electron diffraction. In both alloy systems different structure modifications were observed by high resolution lattice imaging. Stacking faults were much more profuse in the stoichiometric compound than the non-stoichiometric compounds. Basal as well as non-basal plane faults in hexagonal structures were observed. Crystallographic shear plane models are proposed and compared with experimental observations. Dissert. Abstr.

N78-32226 California Univ., Berkeley.
ISOTHERMAL TRANSFORMATION STUDIES ON THE EFFECT OF ALLOYING ELEMENTS (Mo, Ni, Cr, Mn, Al, Si, Co) IN STEELS ON THE KINETICS OF THE AUSTENITE TO BAINITE TRANSFORMATION Ph.D. Thesis
Ana Maria LlopisDeYndurain 1977 213 p
Avail: Univ. Microfilms Order No. 7812663

Thermodilatomeric experiments were performed on seven Fe-C-X ternary systems (where X = Mo, Ni, Cr, Mn, Al, Si, Co) at different alloys concentrations. TTT diagrams for the isothermal decomposition of austenite in the bainite range were obtained. Extension of these experiments included combinations of some of the alloying elements such as Fe-C-Mo-Ni, Fe-C-Mo-Cr, Fe-C-Ni-Cr in order to determine what their interaction effects were in the bainite transformation. All the alloying elements studied accelerated the austenite decomposition for isothermal treatments just above the M sub s giving for the reaction start curve an S-like curve. Present results indicated that Mn, Ni, Cr, and Al retarded the bainite reaction. The bainite reaction below 500 C was unaffected by Si when present by itself and was accelerated by the presence of Co, and by the presence of Mo to a lesser degree. Dissert. Abstr.

N78-32227 California Univ., Berkeley.
DESIGN OF DUPLEX LOW-CARBON STEELS FOR IMPROVED STRENGTH: WEIGHT APPLICATIONS Ph.D. Thesis
Ja-Young Koo 1977 177 p
Avail: Univ. Microfilms Order No. 7812641

Duplex ferrite-martensite (DFM) steels with excellent combinations of strength and formability were selected from first principles, and their microstructure-property relationships established through a systematic investigation of a series of ternary Fe/X/0.1 C steels (X being varying amount of Cr and Si). Duplex processing consists of initial austenitization and quenching to form 100% martensite, followed by annealing in the alpha + gamma range and subsequent quenching. The resultant DFM morphology is controlled by the type and amount of alloying element X. The effects of the structural parameters on controlling the strength-ductility balance are described, and their role during the deformation process characterized. Dissert. Abstr.

N78-32228 Stanford Univ., Calif.
CUMULATIVE FATIGUE DAMAGE IN METALS, VOLUMES 1 AND 2 Ph.D. Thesis
Drew Vernon Nelson 1978 532 p
Avail: Univ. Microfilms Order No. 7814197

Constant amplitude laboratory data was used to predict the life of machine parts and structural components subjected to irregular service loadings. Crack initiation and crack propagation were considered. A summary of the following effects on crack initiation and ways of accounting for them is presented: (1) mean stress, (2) stress concentration, (3) cyclic stress-strain behavior, and (4) load sequence (for both smooth and notched specimens). To predict crack growth under irregular loading from constant amplitude data, two crack growth rate relations were used: (1) a relation which accounts only for mean stress effects and (2) a relation based on an effective stress intensity range related to crack closure concepts. Predictions were obtained using three computerized prediction methods. Dissert. Abstr.

N78-32229* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PROCESS FOR PREPARING HIGHER OXIDES OF THE ALKALI AND ALKALINE EARTH METALS Patent
Pasupati Sadhukhan (Occidental Res. Corp., La Verne, Calif.) and Alexis Bell, inventors (to NASA) (Calif. Univ., Berkeley) Issued 13 Jun. 1978 6 p Filed 19 Jan. 1977 Supersedes N77-17178 (15 - 08, p 0999) Sponsored by NASA
(NASA-Case-ARC-10992-1; US-Patent-4,094,758; US-Patent-Appl-SN-760810; US-Patent-Class-204-164; US-Patent-Class-204-175; US-Patent-Class-423-582; US-Patent-Class-423-583) Avail: US Patent Office CSCL 11F

High purity inorganic higher oxides of the alkali and alkaline earth metals are prepared by subjecting the hydroxide of the alkali and alkaline earth metal to a radio frequency discharge sustained in oxygen. The process is particulary adaptable to the production of high purity potassium superoxide by subjecting potassium hydroxide to glow discharge sustained in oxygen under the pressure of about 0.75 to 1.00 torr.
Official Gazette of the U.S. Patent Office

N78-32230*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EMITTANCE OF TD-NiCr AFTER SIMULATED REENTRY
Ronald K. Clark, Dennis L. Dicus, and W. Barry Lisagor Sep. 1978 22 p refs Presented at the 15th Intern. Thermal Conductivity Conf., Ottawa, 24-26 Aug. 1977
(NASA-TM-78784) Avail: NTIS HC A02/MF A01 CSCL 11F

The effects of simulated reentry heating on the emittance of TD-NiCr were investigated. Groups of specimens with three different preconditioning treatments were exposed to 6, 24, and 30 half-hour simulated reentry exposure cycles in a supersonic arc tunnel at each of three conditions intended to produce surface temperatures of 1255, 1365, and 1475 K. Emittance was determined at 1300 K on specimens which were pre-conditioned only and specimens after completion of reentry simulation exposure. Oxide morphology and chemistry were studied by scanning electron microscopy and X-ray diffraction analysis. A consistent relationship was established between oxide morphology and total normal emittance. Specimens with coarser textured oxides tended to have lower emittances than specimens with finer textured oxides. B.B.

N78-32231*# Cabot Corp., Kokomo, Ind. Dept. of Stellite R and D.
THERMOMECHANICAL PROCESSING OF HAYNES ALLOY NO. 188 SHEET TO IMPROVE CREEP STRENGTH Final Report
D. L. Klarstrom Aug. 1978 193 p refs
(Contract NAS1-13837)
(NASA-CR-3013) Avail: NTIS HC A09/MF A01 CSCL 11F

Improvements in the low strain creep strength of HAYNES alloy No. 188 thin gauge sheet by means of thermomechanical processing were developed. Processing methods designed to develop a sheet with strong crystallographic texture after recrystallization and to optimize grain size were principally studied. The effects of thickness-to-grain diameter ratio and prestrain on low strain creep strength were also briefly examined. Results indicate that the most significant improvements were obtained in the sheets having a strong crystallographic texture. The low strain creep strength of the textured sheets was observed to be superior to that of standard production sheets in the 922 K to 1255 K temperature range. Tensile, stress rupture, fabricability, and surface stability properties of the experimental sheets were also measured and compared to property values reported for the baseline production sheets. J.M.S.

N78-32232# Naval Research Lab., Washington, D. C.
EXPLORATORY INVESTIGATIONS OF LOW CHARPY-V UPPER SHELF ENERGY STEELS WITH IRRADIATION Final Report
J. R. Hawthorne 30 Dec. 1977 15 p refs
(Contract AT(49-24)-0207; NRL Proj. M01-40)
(AD-A055914; AD-E000164; NRL-8171) Avail: NTIS HC A02/MF A01 CSCL 18/10

This report describes exploratory investigations with a low upper-shelf A302-B plate, a companion weld heat-affected zone (HAZ), a low upper-shelf A533-B weld and an A508-2 forging which exhibited a high C sub v energy correlation (=135 J, 100 ft lb) at the drop-weight nil-ductility transition (NDT) temperature. Standard C sub v and fatigue-precracked C sub v specimens were employed for notch ductility and dynamic fracture toughness K sub j determinations, respectively. The studies indicated: (1) approximately equal radiation effects to longitudinal and transverse test orientations for the plate, (2) a significantly lower C sub v upper-shelf level for the HAZ compared to the parent plate (3) greater radiation sensitivity by the HAZ compared to the parent plate as evidenced by transition-temperature elevation, (4) a postirradiation upper-shelf energy for the weld below the code index value of 68 J (50 ft.lb) minimum, and (5) a trend in fracture toughness versus C sub v upper-shelf energy suggestive of a correspondence in these properties. GRA

N78-32233# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
DETERMINATION OF THRESHOLD STRESS INTENSITY FACTORS FOR 7175-T651 ALUMINUM AND ALCOA MA-87 POWDERED ALUMINUM ALLOYS M.S. Thesis
Donald Roy Holloway Sep. 1977 68 p refs
(AD-A055856; AFIT/GAE/MC/77S-1) Avail: NTIS HC A04/MF A01 CSCL 11/6

Threshold stress intensity factors were obtained for two aluminum alloys: 7175-T651 and Alcoa MA-87, a powdered alloy. Crack growth tests were conducted at room temperature on a Sonntag Universal fatigue testing machine. Edge-cracked bend specimens were used in the tests. Crack length was checked periodically using a Gaertner cathetometer coupled with an auxillary lens placed close to the specimen. Tests were performed at stress ratios of R = 0.1 and R = 0.3. It was found that 7175-T651 had a greater fatigue threshold value than MA-87 when compared at the same stress ratio. It was also found that stress ratio had an effect on the threshold stress intensity factors with increasing stress ratio resulting in a smaller fatigue threshold value. Recommendations have been made for further experimentation with regard to threshold stress intensity factors of powdered aluminum alloys. Author (GRA)

N78-32234# Franklin Inst. Research Labs., Philadelphia, Pa.
STRESS CORROSION ENVIRONMENTAL EFFECTS ON AF 1410 Interim Report, 1 May 1977 - 30 Apr. 1978
Victor V. Damiano 1978 68 p refs
(Grant AF-AFOSR-3341-77)
(AD-A055944; FIRL-03G-C4708-01; AFOSR-78-1114TR) Avail: NTIS HC A04/MF A01 CSCL 11/6

AF 1410 plates available from Universal Cyclops through Air Force Materials Laboratory were welded using filler wire fabricated from sheet stock of the same composition as the base plate. The method of welding was cold wire-gas tungsten arc using manual feed. Satisfactory welds having mechanical properties as welded approaching the properties of the base plate in the double austenitized and aged condition were obtained. GRA

N78-32235# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.
TITANIUM ALLOY IGNITION AND COMBUSTION Final Report, 10 Sep. 1976 - 10 Dec. 1977
V. G. Anderson and B. A. Manty 15 Jan. 1978 39 p refs
(Contract N62269-76-C-0429)
(AD-A055443; PWA-FR-9511; NADC-76083-30) Avail: NTIS HC A03/MF A01 CSCL 11/6

The objective of this program was to determine the relative ignition and combustibility characteristics of titanium alloys. Nine titanium alloys and two coatings were subjected to a laser ignition source at each of two conditions of temperature, pressure, and airstream velocity typical of gas turbine engine compressor environments. Three of the alloys did not burn and no significant difference could be established in the burning characteristics of six of the alloys. A chromium-molybdenum coating significantly reduced the magnitude of burn and an ion vapor deposited aluminum coating prevented ignition. The higher temperature environment was shown to produce a more severe burn. Comparison of one test run with results predicted by the analytical model currently under development showed good agreement. Author (GRA)

N78-32236# Naval Surface Weapons Center, White Oak, Md.
A SOURCE MANUAL FOR INFORMATION ON NITINOL AND NiTi
David Goldstein 13 Feb. 1978 34 p refs
(AD-A055688; NSWC/WOL/TR-78-26) Avail: NTIS HC A03/MF A01 CSCL 11/6

This manual is a current listing of most of the published literature on NITINOL and NiTi alloys. It includes a bibliography, titles of a group of NSWC unpublished internal reports and patents issued. Guidelines for obtaining licenses for Navy-owned patents and for technical assistance by the Navy are presented. The manual is intended to aid scientists and designers in locating specific kinds of information on NITINOL shape memory effect alloys. Author (GRA)

N78-32237# Army Construction Engineering Research Lab., Champaign, Ill.
FRACTURE CHARACTERISTICS OF ASTM A-607 PIPE-LINE STEEL, ASTM A-516 STRUCTURAL STEEL, AND ASTM B-209, ALUMINUM ALLOYS 5083 AND 6061 Final Report
J. K. Scott May 1978 47 p refs

(AD-A055520; CERL-TR-M-238) Avail: NTIS HC A03/MF A01 CSCL 11/6

The fracture characteristics of two steels (ASTM A-516 and A-607) and two aluminums (ASTM B-209, alloys 5083 and 6061) were analyzed under tensile, fatigue, and impact loading conditions. The effect of hydrogen embrittlement on the steels' behavior when fractured under tensile and fatigue conditions was investigated. GRA

N78-32238# Wyman-Gordon Co., Worcester, Mass. Research and Development Dept.

EVALUATION OF LUBRICATION SYSTEMS FOR ISOTHERMAL FORGING OF ALPHA-BETA AND BETA TITANIUM ALLOYS Final Technical Report, 1 Apr. 1976 - 15 Jul. 1977

C. C. Chen Nov. 1977 145 p refs
(Contract F33615-76-C-5083)
(AD-A055655; AFML-TR-77-181) Avail: NTIS HC A07/MF A01 CSCL 11/6

This technical report presents the results of the lubrication evaluations on the newly-developed lubricants for isothermal forging of both alpha-beta and beta titanium alloys. It was demonstrated that, for alpha-beta titanium alloy lubricants, each lubricant still has its relative virtues and limitations in manufacturing performance. None of the present lubricants could provide satisfactory lubrication-functions for use in the gas-fired environment. However, several lubricants for beta-titanium alloys displayed excellent combinations of lubricity and adhesion properties in both electric and gas-fired environments and may represent the state of the art for isothermal forging lubricants. Author (GRA)

N78-32239# Duke Univ., Durham, N. C. Dept. of Mechanical Engineering and Materials Science.

NEW CONCEPTS FOR THE ENHANCEMENT OF HIGH STRENGTH ALUMINUM ALLOY PROPERTIES Final Report

Franklin H. Cocks, George W. Pearsall, and Marion L. Shepard Jun. 1978 38 p refs
(Grant AF-AFOSR-2632-74)
(AD-A055840; AFOSR-78-1107TR) Avail: NTIS HC A03/MF A01 CSCL 11/6

The precipitation processes in aluminum alloys are well understood and the identification and analysis of those precipitates primarily responsible for the strengthening effects during precipitation heat treatment is reasonably complete. Less well understood, however, are the roles played by the minor alloying elements involved in the formation of metalloids, dispersoids, and insolubles which are important in controlling, among other things, fineness of grain structure, and the formation of precipitate free zones around grain boundaries. It has lately been found, however, that methanolic solutions of benzoic acid, oxine and chloroform can be used to selectively remove the aluminum alloy matrix by galvanostatic anodic dissolution, while leaving second phase particles intact. GRA

N78-32240# Missouri Univ., Columbia. College of Engineering.

FRETTING FATIGUE AND CORROSION FATIGUE OF METALLIC MATERIALS Final Report, 1 Mar. 1975 - 31 Aug. 1977

David W. Hoeppner Jun. 1978 6 p refs
(Grants DAAG29-75-G-0127; DAAG29-77-G-0098)
(AD-A056144; ARO-12626.2-MS) Avail: NTIS HC A02/MF A01 CSCL 11/6

This report describes the research performed on single crystals of copper and iron, and polycrystals of copper and iron under fatigue and fretting fatigue loading conditions. The orientation of the crystal has a pronounced effect on the fatigue behavior of both the copper and iron fatigue and fretting fatigue behavior. The introduction of a fretting component produces no degradation of fatigue behavior for either the copper or iron for the conditions studied. However, when fretting is introduced on the polycrystals of copper and iron a serious reduction in fatigue life occurs. The report summarizes the documents generated and the major findings of the research as briefly elucidated above. Author (GRA)

N78-32241# Sandia Labs., Albuquerque, N. Mex.

ELECTRODEPOSITION OF ZINC-NICKEL ALLOYS COATINGS

J. W. Dini and H. R. Johnson Oct. 1977 38 p refs Presented at Workshop on Alternatives for Cadmium Electroplating in Metal Finishing, Gaithersburg, Md., 4 Oct. 1977
(Contract EY-76-C-04-0789)
(SAND-77-8511; Conf-771094-1) Avail: NTIS HC A03/MF A01

One possible substitute for cadmium in some applications is a zinc-nickel alloy deposit. It was shown that electrodeposited zinc-nickel coatings containing about 85 percent zinc and 15 percent nickel provided noticeably better corrosion resistance than pure zinc. Present work which supports this finding also shows that the corrosion resistance of the alloy deposit compares favorably with cadmium. ERA

N78-32242# Argonne National Lab., Ill. Materials Science Div.

UNIAXIAL TENSILE PROPERTIES OF ZIRCALOY CONTAINING OXYGEN Summary Report

A. M. Garde and T. F. Kassner Jun. 1977 108 p refs
(Contract W-31-109-eng-38)
(ANL-77-30) Avail: NTIS HC A06/MF A01

The uniaxial stress-strain behavior of Zircaloy-2 and -4, Zircaloy-oxygen alloys with a uniform oxygen distribution, and composite specimens with a ZrO2/alpha beta layer structure was investigated over a wide range temperature strain rate, oxygen content, grain size, texture longitudinal, transverse, and diagonal orientations, and microstructural state, which consists of the equiaxed alpha phase and various transformed beta acicular structures. The work-hardening and strain-rate sensitivity parameters were determined from the experimental results, and the tensile properties were correlated with oxygen concentration, oxygen distribution in the material, and microstructure. Dynamic strain-aging phenomena were observed in Zircaloy at 200, 400, and 700 C, and superplastic deformation occurred at 850 and 1000 deg. An increase in the oxygen concentration in homogeneous Zircaloy-oxygen alloys increased the ultimate tensile strength and decreased the total strain, particularly below approximately 900 C. ERA

N78-32243# Cornell Univ., Ithaca, N. Y.

ELEVATED TEMPERATURE INELASTIC ANALYSIS OF METALLIC MEDIA UNDER TIME-VARYING LOADS USING STATE VARIABLE THEORIES

S. Mukherjee, V. Kumar, and K. J. Chang (Missouri Univ., Rolla) Sep. 1977 45 p refs
(Contract EY-76-S-02-2733)
(COO-2733-12) Avail: NTIS HC A03/MF A01

A general method for analyzing the time dependent inelastic response of three dimensional metallic bodies to arbitrary time varying mechanical loads and temperature is presented. The method is capable of using any of a number of constitutive relations using state variables. For the purpose of illustration, the problems of a hollow sphere, cylinder and thin circular disc subjected to various combinations of internal and external pressures, axial force (or constraint) and torque were analyzed using the proposed analysis procedure. The constitutive equations due to Hart were used in the numerical calculations. Numerical results are presented for the mechanical response of a sphere to various prescribed internal pressure or internal displacement histories. Various experimentally observed phenomena in creep and plasticity such as constant stress creep, stress redistribution, history dependence, creep recovery, plastic work hardening, strain rate sensitivity and Bauschinger's effect are shown to be qualitatively predicted by Hat's model for the multiaxial problems. ERA

N78-32244# Sandia Labs., Albuquerque, N. Mex.

CALCULATION OF SPALL DAMAGE ACCUMULATION IN DUCTILE METALS

L. Davison and M. E. Kipp 1977 13 p refs Presented at Symp. on High Velocity Deformation of Solids, Tokyo, 24 Aug. 1977
(Contract EY-76-C-04-0789)
(SAND-76-5948C; Conf-770837-1) Avail: NTIS HC A02/MF A01

A theory of viscoplastic flow with spall damage accumulation is reviewed, and its incorporation into a computer code for solving problems of propagation of plane waves of uniaxial strain is described. Solutions for plate impact problems covering the range of sample thickness and impact velocity normally encountered in experimental investigations are discussed and shown to be in qualitative accord with observation. ERA

N78-32245# California Univ., Berkeley. Lawrence Berkeley Lab.
ACTIVE SITES FOR HYDROCARBON CATALYSIS ON METAL SURFACES
G. A. Somorjai 18 Oct. 1977 14 p refs Presented at the 26th Meeting of the Intern. Union of Pure and Appl. Chem., Tokyo, 4 Sep. 1977
(Contract W-7405-eng-48)
(LBL-6934; Conf-770950-2) Avail: NTIS HC A02/MF A01

There is a great deal of experimental evidence associating selective bond breaking ability with low coordination number surface sites on transition metal surfaces. Atomic steps break H-H and C-H bonds efficiently while kinks in the steps are required for additional C-C and C=O bond scissions. The blockage of some of the active sites yields the reaction selectivity commonly observed as a result of alloying or upon introduction of certain promoters. Another important parameter in controlling transition metal catalytic activity is the formal oxidation state of the surface metal atom. Oxidation of the surface atoms by oxygen or halogens or their reduction by electron donors (carbon, alkali metals, etc.) changes markedly the catalytic surface chemistry. H2-D2 exchange, hydrocarbon conversion reactions and the hydrogenation of CO are examples to demonstrate the importance of low coordination number sites and surface oxidation state in controlling catalytic activity and selectivity. ERA

N78-32246# Ames Lab., Iowa.
THERMAL AND ELECTRICAL CONDUCTIVITIES OF HIGH PURITY TANTALUM M.S. Thesis - Iowa State Univ.
S. L. Archer Jan. 1978 64 p refs
(Contract W-7405-eng-82)
(IS-T-809) Avail: NTIS HC A04/MF A01

The electrical resistivity and thermal conductivity of three high purity tantalum samples were measured as functions of temperature over a temperature range of 5K to 65K. Sample purities ranged up to a resistivity ratio of 1714. The highest purity sample had a residual resistivity of .76 x 10 to the minus 10 power OMEGA-m. The intrinsic resistivity varied as T(39) from 10K to 31K. The thermal conductivity of the purest sample had a maximum of 840 W/mK at 9.8K. The intrinsic thermal resistivity varied as T(24) from 10K to 35K. At low temperatures electrons were scattered primarily by impurities and by phonons with both interband and intraband transitions observed. The electrical and thermal resistivity is departed from Matthiessen's rule at low temperatures. ERA

N78-32247# Du Pont de Nemours (E. I.) and Co., Aiken, S. C.
MECHANISM FOR HYDROGEN-INDUCED BRITTLE FRACTURE OF AUSTENITIC STAINLESS STEELS
G. R. Caskey 1978 17 p refs Presented at the 107th AIME Ann. Meeting, Denver, 26 Feb. - 2 Mar. 1978
(Contract EY-76-C-09-0001)
(DP-MS-77-86; Conf-780213-1) Avail: NTIS HC A02/MF A01

Internal hydrogen embrittlement of several austenitic stainless steels is known to be accompanied by a change in fracture mode. Type 304L stainless steel is representative of these alloys. Cathodic charging, however, introduces extremely large amounts of hydrogen and ductility losses are observed. The embrittlement mechanism proposed for Type 304L stainless steel and similar alloys is based on results of a continuing program to investigate hydrogen embrittlement of austenitic stainless steels. One central notion of this proposal is that of microcrack formation. ERA

N78-32248# Oak Ridge National Lab., Tenn.
OXIDATION OF HEATED 2 1/4 Cr-1Mo STEEL TUBING IN FLOWING SUPERHEATED STEAM
J. C. Griess, J. H. DeVan, and W. A. Maxwell Apr. 1978 42 p refs
(Contract W-7405-eng-26)
(ORNL-5373) Avail: NTIS HC A03/MF A01

Tests were performed to determine the effect of a high heat flux on the corrosion behavior of 2 1/4 Cr-1 Mo steel in superheated steam. The purpose was to compare the effects of heat flux on oxidation when steam was exposed to either the inner or outer tube surface. All heat flux tests were conducted at a heat flux of 126 kW/ sq m (40,000 Btu/hr sq ft) across the corroding surface and used steam from the superheater circuit of a commercial oil fired power plant. Both air melted and vacuum-arc-remelted (VAR) steels were studied. Tests with the VAR steel at surface temperatures of 502 to 522 C (936 to 972 F) and heated from the inside, showed that for times as long as 10,000 hr the corrosion rate constantly decreased (approximating a parabolic rate law) even though slight oxide exfoliation occurred after 6000 hr. ERA

N78-32249# Sandia Labs., Albuquerque, N. Mex.
STRESS CORROSION CRACKING OF URANIUM-NIOBIUM ALLOYS
N. J. Magnani Mar. 1978 33 p refs
(Contract EY-76-C-04-0789)
(SAND-78-0439) Avail: NTIS HC A03/MF A01

The stress corrosion cracking behavior of U-2 1/4, 4 1/2, 6 and 8 wt% Nb alloys was evaluated in laboratory air and in aqueous Cl(-) solutions. Thresholds for crack propagation were obtained in these environments. The data showed that Cl(-) solutions are more deleterious than air environments. Tests were also conducted in pure gases to identify the species in the air responsible for cracking. These data showed the primary stress corrodent is water vapor for the most reactive alloy, U-2 1/4% Nb, while O2 is primarily responsible for cracking in the more corrosion resistant alloys, U-6 and 8% Nb. The 4 1/2% alloy was found to be susceptible in both H2O and O2 environments. ERA

N78-32250# Sandia Labs., Livermore, Calif.
EFFECT OF MICROSEGREGATION ON THE ETA SOLVUS TEMPERATURE AND FORGED MICROSTRUCTURE OF JBK-75
J. A. Brooks and W. B. Estill Jan. 1978 26 p refs
(Contract EY-76-C-04-0789)
(SAND-77-8289) Avail: NTIS HC A03/MF A01

The effect of microsegregation on eta (Ni3 Ti) phase stability and on the forged microstructure of JBK-75 is discussed. Local variations in titanium content from 1.7 to 3.0 percent were observed in an alloy of overall composition of 2.1 percent titanium. Over this composition range the eta solvus temperature was seen to increase approximately 85 C. The range in eta solvus temperature of highly segregated material can explain the observed duplex grain structure of forged parts. During thermomechanical processing within the eta solvus temperature range, the absence of eta in the low titanium region allows appreciable grain growth. Conversely, the undissolved eta in the higher titanium regions retards grain growth leading to the duplex fine grain-coarse grain microstructure. ERA

N78-32251# National Technical Information Service, Springfield, Va.
CRYOGENIC PROPERTIES OF ALUMINUM AND ALUMINUM ALLOYS. CITATIONS FROM THE NTIS DATA BASE Final Report, 1964 - May 1978
Mona F. Smith Jun. 1978 140 p Supersedes NTIS/PS-77/0503; NTIS/PS-76/0353
(NTIS/PS-78/0511/2; NTIS/PS-77/0503; NTIS/PS-76/0353)
Avail: NTIS HC $28.00/MF $28.00 CSCL 11F

This updated bibliography contains 134 abstracts, 21 of which are new entries to the previous edition. Citations of Federally-funded research include studies on the cryogenic properties of aluminum and its alloys used in superconducting machinery, magnets, space technology, and nuclear reactors. Electrical properties, fatigue, deformation, and welds are included. GRA

N78-32252# National Technical Information Service, Springfield, Va.
CRYOGENIC PROPERTIES OF ALUMINUM AND ALUMINUM ALLOYS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Final Report, 1970 - May 1978

Mona F. Smith Jun. 1978 99 p Supersedes NTIS/PS-77/0504; NTIS/PS-76/0354
(NTIS/PS-78/0512/0; NTIS/PS-77/0504; NTIS/PS-76/0354) Avail: NTIS HC $28.00/MF $28.00 CSCL 11F

This updated bibliography contains 92 abstracts, 17 of which are new entries to the previous edition. Worldwide research on aluminum and its alloys in liquefied gas tanks, superconducting devices, pressure vessels, and spacecraft components are cited. Studies on welds, fracture, and mechanical properties are included. GRA

N78-32253# National Technical Information Service, Springfield, Va.
CATHODIC PROTECTION. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - May 1978
Mona F. Smith May 1978 195 p Supersedes NTIS/PS-77/0429; NTIS/PS-76/0340; and NTIS/PS-75/241
(NTIS/PS-78/0466/9; NTIS/PS-77/0429; NTIS/PS-76/0340; NTIS/PS-75/241) Avail: NTIS HC $28.00/MF $28.00 CSCL 11F

This updated bibliography contains 189 abstracts. Cathodic protection of ships, moorings, nuclear reactors, underground pipes, underwater equipment, and steel reinforcement are presented. The research covers electrochemistry, electrode cleaning, method reliability, and electron microscopy. GRA

N78-32254# National Technical Information Service, Springfield, Va.
CATHODIC PROTECTION, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1974 - 1978
Mona F. Smith May 1978 226 p
(NTIS/PS-78/0467/7) Avail: NTIS HC $28.00/MF $28.00 CSCL 11F

This updated bibliography contains 219 abstracts. Citations of worldwide research on cathodic protection of ships, underground pipelines and cables, oil wells, off shore structures, underwater equipment, and steel reinforcement in concrete are presented. Design, installation procedures, anodes and cathodes, power supplies, interference, and performance are included, none of which are new entries to the previous edition. GRA

N78-32255# National Technical Information Service, Springfield, Va.
CATHODIC PROTECTION, VOLUME 3. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1977 - May 1978
Mona F. Smith May 1978 127 p Supersedes NTIS/PS-77/0430, and NTIS/PS-76/0342
(NTIS/PS-78/0468/5; NTIS/PS-77/0430; NTIS/PS-76/0342) Avail: NTIS HC $28.00/MF $28.00 CSCL 11F

This updated bibliography contains 120 abstracts. Worldwide journal research is cited on cathodic protection of ships, underground pipelines cretes. Design and installation of these systems are discussed. Equipment and performance of cathodic systems are covered. Combined cathodic protection and coating systems are described. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N78-32256* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
HEAT RESISTANT POLYMERS OF OXIDIZED STYRYL-PHOSPHINE Patent
Kazimiera Jola Liliana Paciorek, inventor (to NASA) (Ultrasystems, Inc., Irvine, Calif.) Issued 30 May 1978 12 p Filed 19 Jul. 1976 Supersedes N76-28425 (14 - 19, p 2447) Sponsored by NASA
(NASA-Case-MSC-14903-1; US-Patent-4,092,466; US-Patent-Appl-SN-706424; US-Patent-Class-526-13; US-Patent-Class-260-2P; US-Patent-Class-260-551P; US-Patent-Class-260-606-5P; US-Patent-Class-260-959; US-Patent-Class-526-23; US-Patent-Class-526-27; US-Patent-Class-526-49; US-Patent-Class-526-50; US-Patent-Class-526-275; US-Patent-Class-526-276; US-Patent-Class-526-278; US-Patent-Class-544-195) Avail: US Patent Office CSCL 07D

Homopolymers, copolymers and terpolymers of a styrene based monomer are prepared by polymerizing at least one oxidized styrylphosphine monomer or by polymerizing p-diphenylphosphin-estyrene and then oxidizing the polymerized monomer with an organoazide. Copolymers can also be prepared by copolymeriz-ing styrene with at least one oxidized styrylphosphine monomer. Flame resistant vinyl based polymers whose degradation products are non toxic and non corrosive are obtained.
Official Gazette of the U.S. Patent Office

N78-32257 Johns Hopkins Univ., Baltimore, Md.
FINITE AMPLITUDE TENSILE WAVE PROPAGATION IN STRETCHED VULCANIZED NATURAL RUBBER Ph.D. Thesis
Rajendra Kumar Trimbak Khanwalkar 1978 81 p
Avail: Univ. Microfilms Order No. 7811777

The propagation of tensile pulses in pre-stretched vulcanized natural rubber is investigated. It is found that the Karman-Taylor theory of wave propagation is applicable and that the vulcanized natural rubber is a simple elastic material, and that the quasi-static and the dynamic stress-strain curves are substantially different. A tensile pulse likely to develop into a shock wave at large extension ratios is observed. Dissert. Abstr.

N78-32258 Purdue Univ., Lafayette, Ind.
STRUCTURAL RELIABILITY OF CERAMIC ELECTRICAL EQUIPMENT Ph.D. Thesis
Rafael E. Torres-Cabrejos 1977 205 p
Avail: Univ. Microfilms Order No. 78113130

A method for the evaluation of the reliability of ceramic structural members of electrical equipment under seismic loads is presented. To analyze the effect of vibrations on the ceramic members of electrical equipment, the governing equations are derived in matrix form by the energy method. A method based on the Weibull distribution function is developed to evaluate the seismic reliability of the ceramic members. A practical, simplified approach developed with the use of response spectra analysis to evaluate the probability of failure is presented. This pro-cedure is applied in examples to illustrate its use in the design of electrical equipment structures containing ceramic members. To carry out all the necessary computations, a user-oriented computer program was developed to be used on a minicompu-ter. Dissert. Abstr.

N78-32259 Connecticut Univ., Storrs.
EFFECT OF THE ENVIRONMENT UPON THE TOUGHNESS OF HIGH IMPACT PLASTICS Ph.D. Thesis
Stephen Paul Petrie 1978 121 p
Avail: Univ. Microfilms Order No. 7813858

Tensile testing, fracture mechanics, and statistics were used to investigate the response of polycarbonate (PC) in air and ethanol. The ductile-brittle transition in the static test resulted from the alteration of the state of stress. The effect upon the toughness of PC was predictable in terms of the state of stress. A parametric criterion for the initiation of crazing of PC immersed in ethanol was developed. The principal strain was found to be the necessary criterion, and the growth was found to be perpendicular to the principal strain. The log of the total craze growth in a plate containing a circular hole plotted as a function of log time had a slope of approximately one, which indicates a heterogeneously nucleated growth process. The effect of interaction between stress and solvent was the most significant, which indicates statistically that the mechanism is that of stress-corrosion rather than stress or solvent alone.
Dissert. Abstr.

N78-32260* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
REACTION CURED GLASS AND GLASS COATINGS Patent
Howard E. Goldstein (Stanford Univ.), Daniel B. Leiser (Stanford Univ.), and Victor W. Katvala, inventors (to NASA) (Stanford Univ.) Issued 6 Jun. 1978 8 p Filed 29 Oct. 1976 Supersedes

N77-10201 (15 - 01, p 0031) Sponsored by NASA
(NASA-Case-ARC-11051-1; US-Patent-4,093,771;
US-Patent-Appl-SN-736910; US-Patent-Class-428-312;
US-Patent-Class-65-30R; US-Patent-Class-65-60D;
US-Patent-Class-106-48; US-Patent-Class-106-54;
US-Patent-Class-427-215; US-Patent-Class-427-376A;
US-Patent-Class-427-376B; US-Patent-Class-427-379;
US-Patent-Class-427-380; US-Patent-Class-428-325;
US-Patent-Class-428-331; US-Patent-Class-428-341;
US-Patent-Class-428-427; US-Patent-Class-428-428;
US-Patent-Class-428-446; US-Patent-Class-428-920;
US-Patent-Class-428-406) Avail: US Patent Office CSCL 11B

The invention relates to reaction cured glass and glass coatings prepared by reacting a compound selected from the group consisting of silicon tetraboride, silicon hexaboride, other boron silicides, boron and mixtures with a reactive glass frit composed of a porous high silica borosilicate glass and boron oxide. The glassy composites of the present invention are useful as coatings on low density fibrous porous silica insulations used as heat shields and for articles such as reaction vessels that are subjected to high temperatures with rapid heating and cooling and that require resistance to temperature and repeated thermal shock at temperatures up to about 1482C (2700PF).
Official Gazette of the U.S. Patent Office

N78-32261* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PROCESS FOR PREPARING THERMOPLASTIC AROMATIC POLYMIDES Patent
Vernon L. Bell, inventor (to NASA) Issued 13 Jun. 1978 5 p Filed 28 Mar. 1975 Supersedes N75-29181 (13 - 20, p 2496) Continuation-in-part of abandoned US Patent Appl. SN-448321, filed 5 Mar. 1974
(NASA-Case-LAR-11828-1; US-Patent-4,094,862;
US-Patent-Appl-SN-562992; US-Patent-Class-260-65;
US-Patent-Class-260-47CP; US-Patent-Class-260-49;
US-Patent-Class-260-63R; US-Patent-Class-260-63N;
US-Patent-Class-260-78TF; US-Patent-Appl-SN-448321) Avail: US Patent Office CSCL 11G

A method of preparing insoluble thermoplastic aromatic polyimides is described, having uniquely low softening temperatures by reacting, in a suitable solvent, an aromatic dianhydride, and a meta-substituted aromatic diamine.
Official Gazette of the U.S. Patent Office

N78-32262* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PROCESS FOR SPINNING FLAME RETARDANT ELASTOMERIC COMPOSITIONS Patent
John T. Howarth (Arthur D. Little, Co., Cambridge), Suresh Sheth (Arthur D. Little, Co., Cambridge), Kenneth R. Sidman (Author D. Little, Co., Cambridge), and Arthur A. Massucco, inventors (to NASA) (Arthur D. Little, Co., Cambridge) Issued 13 Sep. 1978 10 p Filed 13 Feb. 1976 Supersedes N76-24409 (14 - 15, p 1913) Division of US Patent Appl. SN-374421, filed 28 Jun. 1973, US Patent-3,956 233 Sponsored by NASA
(NASA-Case-MSC-14331-3; US-Patent-4,094,943;
US-Patent-Appl-SN-657998; US-Patent-Class-264-130;
US-Patent-Class-264-184; US-Patent-Class-264-211;
US-Patent-Class-264-236; US-Patent-3,956,233;
US-Patent-Appl-SN-374421) Avail: US Patent Office CSCL 11E

Flame retardant elastomeric compositions comprised of either spandex type polyurethane having halogen containing polyols incorporated into the polymer chain, conventional spandex type polyurethanes in physical admixture with flame retardant additives, or fluoroelastomeric resins in physical admixture with flame retardant additives were developed. Methods are described for preparing fibers of the flame retardant elastomeric materials and manufactured articles as well as nonelastic materials such as polybenzimidazoles, fiberglass, and nylons, for high oxygen environments. Official Gazette of the U.S. Patent Office

N78-32263*# Virginia Commonwealth Univ., Richmond. Dept. of Chemistry.
ISOMER EFFECTS ON POLYIMIDE PROPERTIES Final Report, 15 Sep. 1972 - 31 Mar. 1978
B. L. Stump 15 Sep. 1978 21 p refs
(Grant NGR-47-002-041)
(NASA-CR-157733) Avail: NTIS HC A02/MF A01 CSCL 11G

Thermally stable polyimide polymers were prepared. Parameters explored include asymmetry of substitution, addition of alkyl substituents to an aromatic ring, and an increase in the number of aromatic rings present in the diamine monomer. It is shown that the use of an asymmetrical diamine in the preparation of a polyimide produces a polymer with a markedly lowered glass transition temperature. This is achieved with little or no sacrifice of thermal stability. An alternate approach taken was to prepare imide monomers which are capable of addition-type polymerization.
J.M.S.

N78-32264*# National Aeronautics and Space Administration, Washington, D. C.
HIGH-TEMPERATURE CERAMICS FOR AUTOMOBILE GAS TURBINES
Peter Walzer Sep. 1978 18 p ref Transl. into ENGLISH of Conf. Paper-77-073 from DGLR Presented at the Symp. ueber Kleingasturbinen, Stuttgart, 11-12 Oct. 1977 18 p Original language document was announced as A78-18708 Transl. by SCITRAN, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75457; Paper-77-073) Avail: NTIS HC A02/MF A01 CSCL 11B

The employment of the high operational temperatures makes it necessary to use, for the construction of the turbines, ceramic materials such as silicon nitride or silicon carbide. Investigations concerning the development of turbine components made of such materials are conducted by a German automobile manufacturer and the ceramics industry. The current status of these investigations is reviewed. Flame tubes and guide-vane rings have successfully passed tests lasting 20 hours. Prototype turbine wheels have withstood the effects of peripheral speeds of 450 m/s. They also showed resistance to thermal shocks which were as high as 6-0 K/s.
Author

N78-32265*# National Aeronautics and Space Administration, Washington, D. C.
HIGH TEMPERATURE CERAMICS FOR AUTOMOBILE GAS TURBINES. PART 2: DEVELOPMENT OF CERAMIC COMPONENTS
P. Walzer, M. Koehler, and P. Rottenkolber Aug. 1978 20 p refs Transl. into ENGLISH from Motortech. Z. (West Ger.), v. 37, Dec. 1976 p 525-529 Original language document was announced as A77-17591 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Volkswagenwerk AG
(NASA-TM-75302) Avail: NTIS HC A02/MF A01 CSCL 11B

The development of ceramic components for automobile gas turbine engines is described with attention given to the steady and unsteady thermal conditions the ceramics will experience, and their anti-corrosion and strain-resistant properties. The ceramics considered for use in the automobile turbines include hot-pressed Si3N4, reaction-sintered, isostatically pressed Si3N4, hot-pressed SiC, reaction-bonded SiC, and glass ceramics. Attention is given to the stress analysis of ceramic structures and the state of the art of ceramic structural technology is reviewed, emphasizing the use of ceramics for combustion chambers and ceramic shrouded turbomachinery (a fully ceramic impeller).
Author

N78-32266# Royal Aircraft Establishment, Farnborough (England).
RELATIONSHIPS BETWEEN THE GLASS TRANSITION TEMPERATURE AND CHAIN RIGIDITY IN POLYMERS
R. Becker Sep. 1977 15 p refs Transl. into ENGLISH from Faserforsch. Textiltech. (West Germany), v. 28, no. 3, 1977 p 107-110
(RAE-Lib-Trans-1938; BR60726) Avail: NTIS HC A02/MF A01

The rigidity factor sigma can be determined by approximative calculation using a structure-relevant increment system based on the additivity principle. The degree of interaction (sigma phi)-1 in which cu phi describes the ratio of the volume at the glass temperature to a hypothetical volume at unperturbed

dimensions, can be regarded as an intermediate control parameter of the glass temperature as expressed by T sub g is similar to (sigma phi)-1. Author

N78-32267# Celanese Research Co., Summit, N.J.
PROCESSING MECHANISMS, STRUCTURES AND MORPHOLOGY OF HIGH TEMPERATURE POLYMERIC ALLOYS Annual Report, Feb. 1977 - Feb. 1978
Ian L. Hay and Jay R. Shaner Apr. 1978 47 p refs
(Contract F49620-77-C-0046; AF Proj. 2303)
(AD-A054772; AFOSR-78-0954TR) Avail: NTIS HC A03/MF A01 CSCL 11/9

In the initial phase of this project the processing conditions expected to optimize interactions at a molecular level between poly (bisbenzimidazobenzophenanthroline) (BBB) and polybenzimidazole (PBI) were investigated. Studies of the mechanical properties and the morphology indicate that binary interactions between BBB-BBB, PBI-PBI and BBB-PBI all occur. Interactions of BBB-BBB occur at temperatures above 500 C while PBI-PBI and BBB-PBI interactions occur at lower temperatures. Separation of these interactions should be possible by varying the processing conditions between temperatures of 350 and 550 C and by using a range of composites prepared both dry-blending and co-precipitation of the two polymers. Author (GRA)

N78-32268# Union Carbide Corp., Tarrytown, N.Y. Chemicals and Plastics Div.
HIGH ENERGY ELASTOMERIC POLYMERS Annual Report, 1 May 1977 - 30 Apr. 1978
Robert S. Neale 24 May 1978 21 p refs
(Contract N00014-75-C-0791; NR Proj. 093-054)
(AD-A055232; Rept-78-1) Avail: NTIS HC A02/MF A01 CSCL 11/9

The overall goal of the work described is to increase the energy content of potential binder polymers useful in the compounding of solid propellant or explosive compositions. The underlying technical principle is that the high energy (HE) modification of pre-formed, linear backbone structures is believed to offer more potential for achieving elastomeric polymers than the direct polymerization of HE monomers. Substantial progress has been made this year in the preparation of aminoalkylsilicone receptor polymers and their one-step reactions with fluorodinitroethanol (FDNE) to afford HE derivatives, whose further conversion to elastomeric products is now under active study. The polysiloxane skeletal framework was selected first for energization because of its often superior flexibility and stability within a wide temperature range. GRA

N78-32269# California Univ., Berkeley. Dept. of Chemical Engineering.
VISCOELASTIC PROPERTIES OF ENTANGLED POLYMER. 4: BINARY BLENDS OF MONODISPERSE HOMOPOLYMERS
D. Soong, M. Shen, and S. D. Hong (JPL) 1 May 1978 37 p refs Submitted for publication
(Contract N00014-75-C-0955)
(AD-A055906; TR-20) Avail: NTIS HC A03/MF A01 CSCL 11/9

In a previous publication from this laboratory, the Rouse-Bueche-Zimm molecular theory of viscoelasticity has been extended by using a transient network model to apply to monodisperse polymers with chain entanglements. Effects of the entanglements were modeled both by the enhanced frictional coefficients and by the additional elastic couplings resulting from the transient entanglement network. For binary blends consisting of two monodisperse polymers with different molecular weights, additional modifications are now required to predict their linear viscoelastic behavior. It is recognized that entanglements not only may form between chains of the same lengths, but also between those of different lengths. For the latter case, the longer chain will in fact have the frictional coefficient of the shorter chain at the point of entanglements. The frequency of such interactions is assumed to be proportional to the weight ratio of the respective component chains in the blend. Equations of motion are formulated for each component and solved numerically for the relaxation spectra. GRA

N78-32270# Boeing Commercial Airplane Co., Seattle, Wash.
ADHESIVE BONDED AEROSPACE STRUCTURES STANDARDIZED REPAIR HANDBOOK Final Report, 1 Oct. 1973 - 30 Sep. 1977
R. E. Horton and J. E. McCarty Dec. 1977 347 p refs
(Contract F33615-73-C-5171)
(AD-A055684; AFML-TR-77-206; AFFDL-TR-77-139) Avail: NTIS HC A15/MF A01 CSCL 01/3

This handbook is the culmination of a five-phase program to develop standardized repair procedures for adhesively bonded aircraft structures. It recommends repair materials and processing methods. It identifies repair procedures for both small and large size repairs. It additionally includes information on equipment and tools and nondestructive inspection techniques.
Author (GRA)

N78-32271# Cincinnati Univ., Ohio. Dept. of Materials Science and Metallurgical Engineering.
EVALUATION OF THE POLYMER-POLYMER INTERACTION PARAMETER FROM THE EQUATION-OF-STATE THERMODYNAMIC THEORY
Ryong-Joon Roe 15 Jun. 1978 19 p refs Submitted for publication
(Contract N00014-77-C-0376)
(AD-A055484; TR-2) Avail: NTIS HC A02/MF A01 CSCL 11/9

The strength of interaction between the segments of dissimilar components greatly influence the morphology of microdomains and hence the properties of polymer-polymer blends and block copolymers. In the theories of polymer-polymer interfaces dealing with such multicomponent systems, the interaction between components is usually expressed in terms of a single parameter which is independent of concentration. The validity of such an approximation is examined in this work in the light of the equation-of-state thermodynamic theory of polymer solutions and mixtures developed by Flory and coworkers. Using the molecular parameters evaluated by these workers, the free energy of mixing for the pairs, polyethylene/polyisobutylene, polyisobutylene/polystyrene and natural rubber/polystyrene was computed.
GRA

N78-32272# Phoenix Chemical Lab., Inc., Chicago, Ill.
FIELD DETERMINATION OF THE ACIDITY OF MIL-L-23699 LUBRICATING OIL Final Report, 2 Jun. - 29 Dec. 1977
A. A. Krawetz and Pricha Klinsuttho Feb. 1978 19 p refs
(AD-A055730; Rept-62269/TR7-1573) Avail: NTIS HC A02/MF A01 CSCL 11/8

Constant speed drive failures associated with the MIL-L-23699 oil degradation required a feasibility study to determine techniques/procedures satisfactory for the field evaluation of oil samples. Results of the study showed that a test procedure based on total acid number was capable of discriminating between MIL-L-23699 oils with total acid numbers above and below 2.0 mg KOH/gram. A prototype test kit (go-no go type) is being assembled for on-site field demonstrations. This maintenance technology support study was conducted under the Analytical Rework Program sponsored by the Naval Air Systems Command (AIR-4114C). Author (GRA)

N78-32273# Pennwalt Corp., King of Prussia, Pa. Central Research and Development Dept.
THE APPLICATION OF ULTRAVIOLET CURE RESINS FOR REPAIR OF COMPOSITES Final Report
H. D. Gillman and J. L. Eichelberger Nov. 1977 15 p refs
(Contract N62269-77-M-7197)
(AD-A055731) Avail: NTIS HC A02/MF A01 CSCL 11/9

This investigation has shown that it is possible to quickly, easily, and safely repair in the field damaged composites using UV curable resins. Although the best repair in this study restored 76% of the strength of the undamaged laminate, stronger repairs should be possible by optimizing the repair method. The nature of this study did not allow for a complete evaluation of all the variables which would affect the strength of these repairs. It is, therefore, reasonable to assume that stronger repairs would be possible by optimizing not only the resin system but also the method of cure (i.e. cure time, light intensity and wavelength), the surface preparation, and the reinforcing material.
Author (GRA)

N78-32274# Oak Ridge National Lab., Tenn.
LOW TEMPERATURE IRRADIATION EFFECTS ON MECHANICAL PROPERTIES OF EPOXY RESIN USED IN SUPERCONDUCTING MAGNETS
Shigehiro Nishijima and Touichi Okada 1977 14 p refs Translated into ENGLISH from Teion Kogaku (Osaka), v. 12, no. 6, 1977 p 224-229 Sponsored by DOE
(ORNL/TR-4612) Avail: NTIS HC A02/MF A01

Superconducting magnets for fusion device are greatly influenced by the radiation environment, and the principal radiation-induced trouble is to arise from the change of mechanical fracture behavior in organic materials used as insulating and/or potting materials. Small compression test specimens of epoxy resin are tested after gamma and pile irradiations at low temperature to determine breaking stress, breaking strain and elastic modulus. A statistical analysis of the data from a large number of small specimens reveals that the effects of gamma and neutron irradiations on the fracture behaviors are observed to be different. This fact suggests that the simulation study by gamma is not safe for neutron irradiation. In the case of reactor irradiation, overall softening is induced accompanied by local hardening and embrittlement. A qualitative explanation to the results is presented and their effect on the performance of the magnets is stated. ERA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N78-32275*# National Aeronautics and Space Administration, Washington, D. C.
OPTICAL MEASUREMENTS OF THE DROPLET SIZE DISTRIBUTION IN THE CASE OF FUEL ATOMIZATION IN SWIRL NOZZLES AND PLANAR AIRBLAST DIFFUSERS
A. Kayser Aug. 1978 39 p refs Transl. into ENGLISH of Conf. paper from Inst. of Propulsion Technol. Presented at DGLR Symp. ueber Kleingasturbinen, Stuttgart, 11-12 Oct. 1977 35 p Original language document was announced as A78-18701 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75334; DGLR-Paper-77-067) Avail: NTIS HC A04/MF A01 CSCL 21D

The theoretical principles of optical methods for the determination of the particle sizes of sprays are considered and aspects of the experimental implementation of these principles are discussed. An experimental device for point-intensity measurements makes use of a helium-neon laser. The cross-sectional area of the laser beam is enlarged with the aid of a lens system to the size of the measurement cross-section. The intensity of the laser light scattered by the spray particles is measured as a function of light direction. Approaches which take into account the total energy of the diffractively scattered light are also discussed and an investigation is conducted regarding the measurement error sources. A description is presented of experimental results obtained in studies of a number of fuel nozzle sprays. Author

N78-32276# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.
USE OF THE JET FUEL THERMAL OXIDATION TESTER (JFTOT) FOR PREDICTING DIESEL FUEL PERFORMANCE Interim Report
Maurice E. LePera and Fred McCaleb Mar. 1978 14 p refs
(AD-A055421; MERADCOM-2235) Avail: NTIS HC A02/MF A01 CSCL 21/4

An investigation was conducted to define the feasibility for using the Jet Fuel Thermal Oxidation Tester (JFTOT) as a laboratory predictor to assess diesel fuel quality relative to operating performance. A methodology was subsequently established to define diesel fuel performance relative to filter pressure differentials at limiting operating temperatures. A variety of diesel fuels and candidate additives were screened using this approach. The modified JFTOT did effectively screen and discriminate between the fuels as a result of their composition, hydrocarbon quality, and possible contaminants. Author (GRA)

N78-32277*# National Aeronautics and Space Administration. Earth Resources Labs., Bay St. Louis, Miss. National Space Technology Lab.
TNT EQUIVALENCY OF M10 PROPELLANT Final Report
F. L. McIntyre and Paul Price Mar. 1978 56 p refs
(Contract MIPR-816B60201-F-4W5)
(NASA-CR-156188; AD-A055977; AD-E400113) Avail: NTIS HC A04/MF A01 CSCL 19/1

Peak, side-on blast overpressure and scaled, positive impulse have been measured for M10 single-perforated propellant, web size 0.018 inches, using configurations that simulate the handling of bulk material during processing and shipment. Quantities of 11.34, 22.7, 45.4, and 65.8 kg were tested in orthorhombic shipping containers and fiberboard boxes. High explosive equivalency values for each test series were obtained as a function of scaled distance by comparison to known pressure, arrival time and impulse characteristics for hemispherical TNT surface bursts. The equivalencies were found to depend significantly on scaled distance, with higher values of 150-100 percent (pressure) and 350-125 percent (positive impulse) for the extremes within the range from 1.19 to 3.57 m/cube root of kg. Equivalencies as low as 60-140 percent (pressure) and 30-75 percent (positive impulse) were obtained in the range of 7.14 to 15.8 m/cube root of kg. Within experimental error, both peak pressure and positive impulse scaled as a function of charge weight for all quantities tested in the orthorhombic configuration.
Author (GRA)

N78-32278# Naval Weapons Support Center, Crane, Ind.
A 1/10 SCALE PILOT FOR THE ECOLOGICAL DEMILITARIZATION OF Mk 25 MARINE LOCATIONS MARKERS/RED PHOSPHORUS COMPOSITION
Frank E. Montgomery and James E. Hort, Jr. 11 Nov. 1977 297 p refs
(AD-A055440; NWSC/CR/RDTR-70) Avail: NTIS HC A13/MF A01 CSCL 19/1

NAVSEA (0332) under WR 74026 tasked NWSC Crane to develop a 1/10 scale pilot plant to reclaim phosphoric acid and other components from the disposal of Mk 25 Marine Location Markers. The typical pyrotechnic formulation for the Mk 25 and Mk 58 Marine Location Markers plus the Mk 6 Aircraft Smoke and Illumination Signal is 53 percent red phosphorus, 34 percent manganese dioxide, 7 percent magnesium, 3 percent zinc oxide and 3 percent linseed oil. The process includes breakdown equipment to extract the red phosphorus composition from the markers and an incineration complex to convert the composition to phosphoric acid suitable for fertilizer application. Processing the composition from the Mk 58 Marine Location Markers and that from the Mk 6 Aircraft Smoke and Illumination Signal through the incineration complex would be identical to that of the Mk 25 - only the composition extraction procedure would differ. As part of the overall development efforts by NWSC Crane, breakdown machines and an incineration complex were designed, fabricated and individually tested in order to obtain necessary data. GRA

N78-32279# Ogden Air Logistics Center, Hill AFB, Utah. Propellant Lab. Section.
PROPELLANT SURVEILLANCE REPORT LGM-30 F AND G STAGE 1, PHASE E, SERIES 4, TP-H1011 Semiannual Report
John A. Thompson Feb. 1978 134 p refs
(AD-A055673; MANCP-390(78)) Avail: NTIS HC A07/MF A01 CSCL 21/9

This report contains propellant test results from cartons of TP-H1011 bulk propellant representing LGM-30 F and G First Stage Minuteman Motors. This report uses a statistical approach to analyze the bulk carton propellant data. Testing was accomplished in accordance with MMWRM Project M829-34CWNL17514. The data from this test period are combined with data from previous testing and entered into the G085 computer for storage, analysis and regression analysis. From the statistical analysis of all data tested to date (twelve and one half years for F and G), significant degradation of the propellant

does not appear likely for at least two years past the oldest data point. GRA

N78-32280# Auburn Univ., Ala. Dept. of Chemistry
CARBORANE BURNING RATE MODIFIERS Progress Report, 1 Jun. 1977 - 1 Mar. 1978
F. A. Johnson 1 Mar. 1978 8 p
(Contract N00024-76-C-5318)
(AD-A055509) Avail: NTIS HC A02/MF A01 CSCL 21/9

Contents: I. Preparation of Starting Materials for Binder Addition Studies; II. Synthesis and Characterization of n-hexylcarborances Capable of Addition to C = C in Polybutadienes; III. Attachment of Carboranes to Polybutadiene Binders; and IV. Mechanism of Carborane Preparation. GRA

N78-32281# Civil and Environmental Engineering Development Office, Tyndall AFB, Fla.
THE AUTOXIDATION OF HYDRAZINE VAPOR Final Report, Nov. 1975 - Dec. 1977
Daniel A. Stone Jan. 1978 46 p refs
(AD-A055467; CEEDO-TR-78-17) Avail: NTIS HC A03/MF A01 CSCL 13/2

Results of three studies on the ambient temperature autoxidation of hydrazine vapor are presented. These studies show that the main reaction is $N2H4 + O2 = N2 + 2H2O$, with ammonia being produced as a side product. The rate of the main reaction, as well as the side reaction producing ammonia, is greatly influenced by the surface to volume ratio and the surface composition of the reaction vessel. Hydrazine half life varied from a few minutes to several hours depending upon experimental conditions. Author (GRA)

N78-32282# Energy Research and Development Administration, Washington, D. C.
ALTERNATIVE FUELS DEMONSTRATION PROGRAM Final Report
Sep. 1977 362 p refs
(ERDA-1547-Vol-2) Avail: NTIS HC A16/MF A01

Alternatives to the proposed demonstration plant program, including environmental trade-off possibilities, and a discussion of comments (and the responses) received on the draft environmental statement are given. Five appendices are devoted to: synthetic fuel processes, air emission calculations, solid waste calculations, long term scenarios and comment letters. ERA

N78-32283# Oak Ridge National Lab., Tenn.
SYNTHETIC FUELS PROCESS RESEARCH DIGEST
F. M. OHara, Jr. and Alan R. Spiewak, ed. Nov. 1977 69 p refs
(Contract W-7405-eng-26)
(ORNL/FE-1) Avail: NTIS HC A04/MF A01

Coal energy conversion processes are described. They are: (1) coal gasification with chemically incorporated catalysts, (2) flash hydrolysis of coal, (3) zinc chloride hydrocracking of coal and coal extracts, and (4) conversion of methanol to high octane gasoline. L.S.

N78-32284# Department of Scientific and Industrial Research, Lower Hutt (New Zealand).
METHANOL FROM NATURAL GAS FOR ENGINE FUEL
B. T. Judd, B. V. Walker, E. E. Graham (Canterbury Univ., N. Zealand), I. F. Rees (Canterbury Univ., N. Zealand), and E. K. Girardin (Canterbury Univ., N. Zealand) N. Zealand Energy Res. and Develop. Comm. Jun. 1977 30 p refs
(NP-22771; IR-2; Rept-23) Avail: NTIS (US Sales Only) HC A03/MF A01; ERDA Depository Libraries

The water tolerance of the methanol/i-octane/benzene system was studied, including the effect on the water tolerance of the presence of selected additives. The conclusion that methanol/gasoline/i-butanol blends can be obtained of adequate stability for commercial distribution is derived. Results show that the use of emulsifying agents to achieve stable blends is not technically possible at the present time. The corrosive effect of menthanol on the materials currently used in vehicle fuel systems and in the fuel distribution system is discussed. It is recognized that the introduction of methanol/gasoline blends could create problems in the area of materials compatibility vis-a-vis gasoline and it is recommended that additional work be initiated to provide more detailed information than is presently available. The problem of increased vapor pressure and methods of distribution of methanol/gasoline blends are noted. Results of initial experimental work undertaken with a single cylinder Ricardo engine are described. The need for further extensive work is indicated, however, both with single cylinder and multicylinder engines. ERA

N78-32285# Brookhaven National Lab., Upton, N. Y.
HYDROGEN-TECHNOLOGY EQUIPMENT TEST PROGRAM AT BNL
G. Strickland, G. Beaufrere, and A. H. Rosso 1977 11 p refs Presented at DOE Ann. Chemical Energy Storage and Hydrogen Energy System Contracts Review, Baltimore, Md., 16 Nov. 1977
(Contract EY-76-C-02-0016)
(BNL-23931; Conf-771131-5) Avail: NTIS HC A02/MF A01

In furthering the development of hydrogen energy technology it is essential to test both major and supporting components on a practical scale. The Hydrogen-Technology Advanced-Component Test System (HYTACTS) is being constructed to fulfill this need. Components for production of hydrogen by electrolysis, storage of hydrogen as a metal hydride, and use in several types of energy conversion devices will be tested and evaluated. The first application to be evaluated uses hydrogen as an energy carrier in an electric-energy storage system. Off peak or spinning reserve power is used to electrolyze hydrochloric acid; the hydrogen and chlorine are stored for recombination in the same cell when the demand for power exceeds the system capacity. Hydrogen stored in containers of hydride will also be tested for use as an automotive fuel. The program phases are described along with some details on the equipment to be tested in the hydrogen storage section of the system now being constructed. ERA

N78-32286# Institute of Gas Technology, Chicago, Ill.
DEVELOPMENT OF COMBUSTION DATA TO UTILIZE LOW Btu GASES AS INDUSTRIAL PROCESS FUELS Annual Report, 1 Oct. 1976 - 30 Sep. 1977
Richard T. Waibel Jan. 1978 40 p
(Contract EX-76-C-01-2489; Proj. 8985)
(FE-2489-16) Avail: NTIS HC A03/MF A01

The combustion data needed to retrofit existing industrial burners to low and medium Btu fuel gases were provided. The pilot-scale furnace was modified to allow the insertion of cooling tubes to provide an adjustable furnace load. This allows the furnace to simulate a variety of industrial processes. A special gas generating system for producing the necessary low and medium-Btu gases was constructed. A Bloom baffle burner, representative of the forward flow type of burner, was installed as the first type of burner to be tested. The cooling tubes were adjusted to simulate the load in the preheat zone of a five-zone steel slab reheat furnace, and natural gas baseline data were collected with an input of 5.25 million Btu/hr. The combustion trials included measurements of the thermal efficiency, heat absorption profile, flame shape, flame temperatures, resonance noise level, and flow direction profiles. The thermal efficiencies were 35% for natural gas, 26% for KTO, 23% for WGA, and 22% for WA. ERA

N78-32287# Mobil Research and Development Corp., Paulsboro, N. J. Process Research and Technical Service Div.
ECONOMIC SCREENING EVALUATION OF UPGRADING COAL LIQUIDS TO TURBINE FUELS Final Report
M. J. Dabkowski, R. H. Heck, A. V. Perrella, M. Schreiner, Jr., and T. R. Stein Mar. 1978 76 p refs Sponsored by Electric Power Research Inst.
(EPRI-AF-710) Avail: NTIS HC A05/MF A01

Experimental fixed bed hydroprocessing data were used to estimate costs for a 20 MB/SD hydrotreater including waste water treater and sulfur plant using both utility and equity methods of financing. The costs of upgrading the five coal liquids from the H-Coal and Solvent Refined Coal (SRC) processes vary from $0.34 to $2.59/MMBTU of liquid fuel product with utility financing (1976 dollars, 0 percent/year inflation) and $0.36 to $2.87/MMBTU with equity financing (1980 dollars, 5 percent/year inflation). Cost is a function of the raw coal liquid quality and the hydroprocessing severity necessary to achieve a given

product quality. Approximately one-half of the processing cost is for hydrogen input; the other half is about equally divided between capital recovery and operating costs. Capital investment ranged from $39. MM to $273 MM for utility financing (1976 dollars) and $45 MM to $308 MM for equity financing (1980 dollars). ERA

N78-32288# Department of Energy, Washington, D. C. Div. of Transportation Energy Conservation.
PROGRAM PLANNING DOCUMENT: HIGHWAY VEHICLE ALTERNATIVE FUELS UTILIZATION PROGRAM (AFUP)
Apr. 1978 96 p refs
(DOE/CS-0029) Avail: NTIS HC A05/MF A01

An alternative automobile fuels research program to assess the feasibility of replacing petroleum as the fuel for highway vehicles in the 1985 to 2000 and beyond time frame is described. Topics discussed include: (1) a summary and overview; (2) an analysis of the transportation energy problem and its solution; (3) the justification for a Federal role; (4) technology assessment summary; (5) goals and strategy of the program; and (6) scope of the program. ERA

N78-32289# Oak Ridge National Lab., Tenn. Chemistry Div.
HYDROGEN PRODUCTION METHODS
C. E. Bamberger 1978 13 p refs Presented at the Symp. on Energy and Develop. in the Americas, Santos, Brazil, 12 Mar. 1978
(Contract W-7405-eng-26)
(CONF-780325-1) Avail: NTIS HC A02/MF A01

Methods presently used and proposed are reviewed. Since it is expected that water will be the only abundant source of hydrogen available in the future, the different ways in which water can be decomposed and the possible primary sources of energy that may be used are emphasized. Thermochemical cycles are described in more detail than other methods. Thermochemical cycles consist of several chemical reactions run in a sequence at different temperatures and all the chemicals involved, except water, are regenerated and reused continuously. ERA

N78-32290# Air Products, Inc., Allentown, Pa. Corporate Research Dept.
CHEMICAL CHARACTERIZATION, HANDLING, AND REFINING OF SOLVENT REFINED COAL TO LIQUID FUELS Final Report
E. N. Givens, M. A. Collura, W. Alexander, E. J. Greskovich, C. D. Engelman, J. B. Wetherington, C. W. Clump (Lehigh Univ., Bethlehem, Pa.), and E. K. Levy (Lehigh Univ., Bethlehem, Pa.) Sep. 1977 297 p refs
(Contract EY-77-C-01-2003)
(FE-2003-27) Avail: NTIS HC A13/MF A01

Solvent refined coal (SRC) products from the Wilsonville, Alabama and Tacoma, Washington liquefaction facilities were characterized by a broad range of chemical methods. Analytical procedures were established to analyze feed and products from the hydroprocessing of these SRC materials in a unit designed and built specifically for processing residual materials. Authentic and synthetic filtrates were processed upflow in hydrogen over three different commercially available catalysts. Residual (greater than 850 F boiling point) SRC conversions up to 46 wt percent were observed under typical hydrotreating conditions on authentic filtrate over a cobalt molybdenum catalyst. A synthetic filtrate comprised of creosote oil containing 52 wt percent Tacoma SRC was used for evaluating nickel molybdenum and nickel tungsten catalysts. Nickel molybdenum on alumina catalyst converted more 850 F+ SRC, consumed less hydrogen and produced a better product distribution than nickel tungsten on silica alumina. ERA

N78-32291# Texas Technological Univ., Lubbock.
CONVERSION OF CATTLE FEEDLOT MANURE TO ETHYLENE AND AMMONIA SYNTHESIS GAS Final Report, 1 Jan. 1974 - 30 Jun. 1977
William J. Huffman, James E. Halligan, and Roger L. Peterson Feb. 1978 74 p refs
(Grant EPA-S-802934)
(PB-280189/2; EPA-600/2-78-026) Avail: NTIS HC A04/MF A01 CSCL 07A

A partial oxidation reactor was scaled-up to evaluate the potential for producing an ammonia synthesis gas from cattle feedlot residue. The synthesis gas from the reactor can be further processed to produce ammonia, using existing commercial technology. A 2.5 meter long, falling-bed reactor was designed, constructed, and operated along with supporting feed and recovery equipment; manure feed rates to the reactor ranged from 7.7 to 23.6 kilograms per hour. The results show that significant yields of an ammonia synthesis gas and ethylene can be produced in the same reactor when the system is fed with a mixture of air, steam, and manure. GRA

N78-32292# National Technical Information Service, Springfield, Va.
HYDROGEN USE AS A FUEL. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - May 1978
Audrey S. Hundemann Jun. 1978 167 p Supersedes NTIS/PS-77/0522; NTIS/PS-76/0458
(NTIS/PS-78/0635/9; NTIS/PS-77/0522; NTIS/PS-76/0458)
Avail: NTIS HC $28.00/MF $28.00 CSCL 21D

Federally-funded research studies pertaining to the technical feasibility of using hydrogen as a fuel for vehicular transportation, electric power generation, and both subsonic and supersonic aircraft are discussed. Excluded are studies on hydrogen production and storage. These topics are covered in other bibliographies. This updated bibliography contains 162 abstracts, 29 of which are new entries to the previous edition). GRA

N78-32293# National Technical Information Service, Springfield, Va.
NATURAL GAS: SUPPLY, DEMAND AND UTILIZATION, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1976 - Jun. 1978
Audrey S. Hundemann Jun. 1978 259 p Supersedes NTIS/PS-77/0574; NTIS/PS-76/0498
(NTIS/PS-78/0621/9; NTIS/PS-77/0574; NTIS/PS-76/0498)
Avail: NTIS HC $28.00/MF $28.00 CSCL 21D

Abstracts pertaining to natural gas supply and demand, industrial and residential consumption, fuel substitution, availability, costs, Government policies, and regulations are presented. Studies dealing with projections of natural gas use and the economics of supply and demand are included. (This updated bibliography contains 254 abstracts, 90 of which are new entries to the previous edition.) GRA

N78-32294# National Technical Information Service, Springfield, Va.
HYDROGEN PRODUCTION. A BIBLIOGRAPHY WITH ABSTRACTS Final Report, 1967 - May 1978
Diane M. Cavagnaro Jun. 1978 260 p Supersedes NTIS/PS-77/0492; NTIS/PS-76/0459
(NTIS/PS-78/0514/6; NTIS/PS-77/0492; NTIS/PS-76/0459)
Avail: NTIS HC $28.00/MF $28.00 CSCL 21D

A bibliography containing 254 abstracts concerning the manufacturing of hydrogen by electrolysis, coal gasification, and other techniques is presented. Both experimental research and production on the industrial scale was reviewed. Production methods, as well as economic studies are also included. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N78-32295 California Univ., Berkeley.
IMPLEMENTATION OF ENDOCHRONIC THEORY FOR ANALYSIS OF CONCRETE STRUCTURES Ph.D. Thesis
Ignatius Pierre DeVilliers 1977 153 p
Avail: Univ. Microfilms Order No. 7812536

Development of a nonlinear analysis procedure which can account for all important mechanical properties of concrete and which as applicable to a wide variety of structures and loads is reported. A two-dimensional finite element was developed for the analysis of plane and axis symmetric concrete structures. This element was incorporated into ANSR, a general purpose computer program for the static and dynamic analysis of nonlinear structures. The endochronic theory for concrete, which describes the behavior of concrete in compression and in tension up to

cracking, was judged to be the most comprehensive theory available. Reinforcing bars were modeled as simple truss bar elements with elastoplastic force-extension relationships. A number of single element examples were analyzed under a variety of strain states to check the behavior of the model. Two larger examples, cantilever beam and a wall panel, subjected to monotonic and cyclic loading were analyzed. Dissert. Abstr.

N78-32296*# Little (Arthur D.), Inc., Cambridge, Mass.
STUDY OF THERMAL INSULATION FOR AIRBORNE LIQUID HYDROGEN FUEL TANKS Final Report
F. E. Ruccia, R. S. Lindstrom, and R. M. Lucas Sep. 1978 117 p refs
(Contract NAS1-14157)
(NASA-CR-158920) Avail: NTIS HC A06/MF A01 CSCL 20L

A concept for a fail-safe thermal protection system was developed. From screening tests, approximately 30 foams, adhesives, and reinforcing fibers using 0.3-meter square liquid nitrogen cold plate, CPR 452 and Stafoam AA1602, both reinforced with 10 percent by weight of 1/16 inch milled OCF Style 701 Fiberglas, were selected for further tests. Cyclic tests with these materials in 2-inch thicknesses bonded on a 0.6-meter square cold plate with Crest 7410 adhesive systems, were successful. Zero permeability gas barriers were identified and found to be compatible with the insulating concept. G.Y.

N78-32297# Bendix Corp., Kansas City, Mo.
MACHINABILITY OF METALS AS RELATED TO MINIATURE PRECISION COMPONENTS
L. K. Gillespie Jan. 1978 115 p refs Revised
(Contract EY-76-C-04-0613)
(BDX-613-1723-Rev) Avail: NTIS HC A06/MF A01

Tool geometry and workpiece material ion to produce low cutting forces, small fillet radii, smooth surface finishes, and burr-free edges required for the production of reliable miniature precision parts have indicated that tool geometries typically specified for general machining applications produce optimum results. Surface finishes of 0.56 to 1.07 micron AA (22 to 40 microinches) can be produced while maintaining 76.2-micron (0.003 inch) fillet radii in ferrous and beryllium-copper alloys. Tool life was extremely short when fillet radii less than 76.2 micron must be maintained. Materials having high strain-hardening exponents produced large burrs. ERA

N78-32298# Texas Univ. at Austin. Center for Highway Research.
FATIGUE AND REPEAT-LOAD ELASTIC CHARACTERISTICS OF INSERVICE PORTLAND CEMENT CONCRETE
John A. Crumley and Thomas W. Kennedy Jun. 1977 67 p refs Sponsored in part by DOT Prepared in cooperation with Texas State Dept. of Highways and Public Transportation, Austin
(PB-280124/9; CFHR-3-9-72-183-9; FHWA/TX-78-183-9) Avail: NTIS HC A04/MF A01 CSCL 13C

The results of an investigation of the resilient elastic and fatigue behavior of inservice concrete from pavements in Texas are summarized. Static indirect tensile tests were conducted in order to estimate the average tensile strength of each of the four projects tested. Repeated-load indirect tensile tests were conducted to determine the fatigue and resilient characteristics and the relationship between fatigue life and stress/strength ratio. Deformation measurements were taken during fatigue testing in order to determine the resilient elastic properties of the material and the changes in these properties during the test period. In addition, estimates of the variation in fatigue life and elastic properties were made. GRA

N78-32299# Transportation Research Board, Washington, D. C.
PAVEMENT SURFACE PROPERTIES AND PERFORMANCE
S. K. Agrawal, J. J. Henry, J. E. Martinez, Bruce McDonald, and Robert R. Blackburn 1977 57 p refs
(PB-280266/8; TRB/TRR-633) Avail: NTIS HC A04/MF A01 CSCL 13B

Topics of discussion are: (1) technique for evaluating hydroplaning potential of pavements; (2) effects of pavement grooving on friction, braking, and vehicle control; (3) photographic technique for estimating skid number and speed gradients of pavements; (4) relation of accidents and pavement friction on rural, two-lane roads; (5) critique of tentative skid-resistance guidelines; (6) rehabilitation decision model; (7) prediction of rigid-pavement performance from cumulative deflection history; (8) performance of the May's road meter. GRA

N78-32300# National Technical Information Service, Springfield, Va.
CONCRETE POLYMER COMPOSITES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jun. 1978
Mona F. Smith Jun. 1978 203 p Supersedes NTIS/PS-77/0588; NTIS/PS-76/0523; NTIS/PS-75/475; and COM-74-11535
(NTIS/PS-78/0601/1; NTIS/PS-77/0588; NTIS/PS-76/0523; NTIS/PS-75/475; COM-74-11535) Avail: NTIS HC $28.00/MF $28.00 CSCL 13C

These Federally-sponsored research reports cover the production, hardening, uses, and properties of concrete polymer composites. Major potential applications include piping, building panels, bridge decking, distillation vessels, and tunnel supports. Both polymer aggregate concretes and polymer impregnated portland cement concretes are cited. GRA

N78-32301# National Technical Information Service, Springfield, Va.
CONCRETE POLYMER COMPOSITES. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Jun. 1978
Mona F. Smith Jun. 1978 169 p Supersedes NTIS/PS-77/0589 and NTIS/PS-76/0524
(NTIS/PS-78/0602/9; NTIS/PS-77/0589; NTIS/PS-76/0524) Avail: NTIS HC $28.00/MF $28.00 CSCL 13C

The citations cover worldwide research on concrete polymer composites including both polymer aggregate concretes as well as polymer impregnated portland cement concretes. The reports discuss their production, hardening, uses, and properties. Also cited are studies on applications such as piping, building panels, bridge decking, tunnel supports, and highway pavements. GRA

N78-32302# Wisconsin Univ. - Milwaukee.
PROCEEDINGS OF MULTI-STATION, DIGITALLY CONTROLLED MANUFACTURING SYSTEMS WORKSHOP
Jan. 1977 180 p refs Workshop held at Milwaukee, 12-14 Jan.1977
(Grant NSF APR-76-11416)
(PB-281109/9; NSF/RA-770104) Avail: NTIS HC A09/MF A01 CSCL 13I

The workshop attempts to provide a sound basis for increasing understanding of Flexible Manufacturing Systems (FMS) and the entire batch production process. Specifically, this workshop brings together people with expertise in FMS in order to define the systems, to assess the state of the art in design and operation, and to identify research issues that require attention. Panelists respond to each of the major topic papers, which treat hardware components, software components, and the management-economic issues associated with FMS. A later paper discusses the various levels of sophistication of these systems and the state-by-stage implementation of an actual system. GRA

N78-32303# Virginia Inst. for Scientific Research, Richmond.
DESIGN OF OVERLAYS FOR FLEXIBLE PAVEMENTS BASED ON AASHTO ROAD TEST DATA
N. K. Vaswani Feb. 1978 30 p refs Sponsored by DOT
(PB-280920/0; VHTRC-78-R37) Avail: NTIS HC A03/MF A01 CSCL 13B

The AASHTO Road Tests included studies on 99 overlays, but they failed to produce conclusive results and hence provided no guidance for overlay designs. In the present investigation the raw data on the 99 overlays tested at the AASHTO Road Tests were evaluated. In the process, the raw data on the pavements that were overlaid also had to be evaluated. A relationship between pavement serviceability, 18 kip equivalents, and the thickness index of the pavements before the overlay was determined and was found to apply to the overlaid pavements. Based on this relationship, the strength coefficient of the overlay was determined

and a method of designing the thickness of an overlay was developed. GRA

N78-32304# National Technical Information Service, Springfield, Va.
WOOD PRESERVATION. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jun. 1978
Robena J. Brown Jul. 1978 116 p
(NTIS/PS-78/0662/3) Avail: NTIS HC $28.00/MF $28.00 CSCL 11L

A bibliography containing 111 abstracts concerning research on wood preservation is presented. Wood preservatives for use against attack by marine borers, fungus, and moisture decay are described. Wood treatment methods are also cited with some studies comparing their effectiveness. GRA

N78-32305# National Technical Information Service, Springfield, Va.
WOOD PRESERVATION. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1964 - Jun. 1978
Robena J. Brown Jul. 1978 175 p
(NTIS/PS-78/0663/1) Avail: NTIS HC $28.00/MF $28.00 CSCL 11L

These abstracts of worldwide research contain information on wood preservation. Studies describing the different types of wood preservatives used, treatment methods, and durability of the preservatives are cited. GRA

N78-32306# National Technical Information Service, Springfield, Va.
TEXTILE DYEING PROCESSES, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1975 - Jun. 1978
Diane M. Cavagnaro Jun. 1978 226 p Supersedes NTIS/PS-77/0602
(NTIS/PS-78/0647/4; NTIS/PS-77/0602) Avail: NTIS HC $28.00/MF $28.00 CSCL 11E

Worldwide citations cover industrial processes used in the fabric dyeing industry. Topics cover the machinery, chemistry of the dyes as well as the synthesis, process performance and design, the different ways that textile dyes are used, and some pollution studies. GRA

N78-32307# California Univ., Berkeley. College of Engineering.
SEISMIC SAFETY OF EXISTING BUILDINGS AND INCENTIVES FOR HAZARD MITIGATION IN SAN FRANCISCO: AN EXPLORATORY STUDY
A. J. Meltsner Dec. 1977 86 p refs
(Grant NSF ENV-76-82384)
(PB-281970/4; UCB/EERC-77/28) Avail: NTIS HC A05/MF A01 CSCL 13M

The seismic safety of existing buildings is not solely a matter of engineering design and assessment of seismological risk. Within any community there are likely to be different perceptions of the public interest. It seems clear that what is needed, in addition to engineering studies to develop appropriate procedures for evaluating and coping with the hazard from existing buildings, is knowledge about the range of appropriate incentives which might prove useful for governments to use to facilitate implementation of these procedures. An exploratory study was conducted of a number of possible incentives and options which have been discussed in the past by public officials and conceivably might be adopted in the future. GRA

N78-33028# Joint Publications Research Service, Arlington, Va.
PRODUCTION OF EXPERIMENTAL MODELS OF COMPLEX INSTRUMENTS IMPROVED
D. F. Guz, I. I. Gut, and A. I. Kukhlevskiy *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 44 (JPRS-71659) 10 Aug. 1978 p 50-53 refs Transl. into ENGLISH from Prib. Sist. Upr. (Moscow), no. 5, 1978 p 47 (For primary document see N78-33024 23-99)
Copyright. Avail: NTIS HC A05/MF A01

N78-33029# Joint Publications Research Service, Arlington, Va.
MEASURING AND INFORMATION SYSTEMS CONFERENCE, REVIEWED
In its Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 44 (JPRS-71659) 10 Aug. 1978 p 54-60 refs Transl. into ENGLISH from Prib. Sist. Upr. (Moscow), no. 5, 1978 p 55-58 Conf. held at Baku, 1977 (For primary document see N78-33024 23-99)
Copyright. Avail: NTIS HC A05/MF A01

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N78-32308 Stanford Univ., Calif.
INTERACTION OF ELECTROMAGNETIC AND ACOUSTIC WAVES IN A STOCHASTIC ATMOSPHERE Ph.D. Thesis
Nirdosh Bhatnagar 1978 116 p
Avail: Univ. Microfilms Order No. 7814156

In the Stanford radio acoustic sounding system (RASS), an electromagnetic signal is made to scatter from a moving acoustic pulse train. Under a Bragg-scatter condition, maximum electromagnetic scattering occurs. The scattered radio signal contains the signature of the atmosphere as a function of the acoustic pulse position. RASS performance is assessed in a real atmosphere where coherency of the acoustic pulse is degraded as it propagates vertically into the lower atmosphere. The only assumption made is that the electromagnetic wave is not affected by stochastic perturbations in the atmosphere. Dissert. Abstr.

N78-32309 California Univ., Berkeley.
SIMULATION OF THE URBAN RADIO PROPAGATION CHANNEL Ph.D. Thesis
Homayoun Hashemi 1977 367 p
Avail: Univ. Microfilms Order No. 7812594

The urban radio propagation channel is simulated on a digital computer. The simulation capability can then be used in the design and testing of urban communication systems as a substitute for costly hardware experiments. The simulation is based on a hypothetical experiment: a vehicle travels through the channel at a not-necessarily-constant speed and records samples of the channel's response to a very narrow pulse at points separated by a distance d(which can also vary). The final simulation program is presented in a package labled SURP. The model is capable of generating the response of the multipath fading channel to the transmission of any narrowband or wideband signal so it can be used in active design of urban communication systems. As an example, application of the model in simulating a narrowband transmission is presented. Dissert. Abstr.

N78-32310 California Inst. of Tech., Pasadena.
COST AND TRAFFIC ANALYSIS OF DEMAND ACCESS SATELLITE NETWORKS Ph.D. Thesis
James Laurens Latimer 1978 156 p
Avail: Univ. Microfilms Order No. 7813503

A method using a Markov process model is described and used to analyze the traffic capacity and call blockage probability of a single channel per carrier satellite network. The model is shown to be suitable for telephone traffic. The traffic density for certain networks whose states can be ordered in a linear fashion (birth/death process) is derived and shown to exhibit an Erlang B distribution. The application of the Erlang B distribution to preassigned and limited cases of fully-variable demand access and SVDA (semi-variable demand access) is demonstrated. The Erlang B equation does not apply when an SVDA network exhibits partial sharing of channels by different earth stations. An example of this is given and the capacity and blockage probability solved exactly by the use of steady state Markov statistics. The traffic capacity and blockage for a satellite with channel switching capability in the repeater is shown to be equivalent to an SVDA network. Dissert. Abstr.

N78-32311 Arizona Univ., Tucson.
A METHOD FOR THE DIGITAL TRANSMISSION OF HUMAN SPEECH AT LOW DATA RATES Ph.D. Thesis
Robert George Semelsberger 1978 317 p
Avail: Univ. Microfilms Order No. 7813893

A method for the transmission of human speech at data rates near one thousand bits per second is given. Linear Predictive Coding is the basis for the rate reduction method. In the application discussed, only a playback mode is necessary. One of the techniques used to arrive at a one kilobit transmission rate precludes the use of the complete system in real time, two way applications. A prototype system was built using the final transmission system recommended here. It can transmit speech information from a central site, and reconstruct the speech waveform at remote locations using less than one thousand bits per second of transmission bandwidth. The techniques which were used, as well as the details of the final transmission system, are given. Dissert. Abstr.

N78-32312*# George Washington Univ., Washington, D. C. Program of Policy Studies in Science and Technology.
VIDEOCONFERENCING VIA SATELLITE: OPENING CONGRESS TO THE PEOPLE: SUMMARY REPORT
Fred B. Wood, Vary T. Coates, Robert L. Chartrand, and Richard F. Ericson Feb. 1978 37 p
(Grant NsG-3130)
(NASA-CR-157258) Avail: NTIS HC A03/MF A01 CSCL 17B

Action research is presented to evaluate, through actual demonstrations, whether satellite videoconferencing can provide a new mechanism for informed dialog between congressmen and constituents and as a result strengthen the legislative process. G.Y.

N78-32313*# National Aeronautics and Space Administration, Washington, D. C.
A MULTILEVEL SYSTEM OF ALGORITHMS FOR DETECTING AND ISOLATING SIGNALS IN A BACKGROUND OF NOISE
L. S. Gurin and K. A. Tsoy Oct. 1978 42 p refs Transl. into ENGLISH of "Mnogourovnevaya Sistema Algoritmov Obnaruzheniya i Vdeleniya Signalov na Fone Pomekh", Rept. PR-276 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1976 p 1-41 Transl. by SCITRAN, Santa Barbara, Calif.
(Contract NASw-2791)
(NASA-TM-75541; PR-276) Avail: NTIS HC A03/MF A01 CSCL 17B

Signal information is processed with the help of algorithms, and then on the basis of such processing, a part of the information is subjected to further processing with the help of more precise algorithms. Such a system of algorithms is studied, a comparative evaluation of a series of lower level algorithms is given, and the corresponding algorithms of higher level are characterized. G.G.

N78-32314*# National Aeronautics and Space Administration, Washington, D. C.
LOCALIZATION OF NON-STATIONARY SOURCES OF ELECTROMAGNETIC RADIATION WITH THE AID OF PHASOMETRY
G. A. Mersov Sep. 1978 23 p refs Transl. into ENGLISH of "Lokalizatsiya Nestationarnykh Istochnikhov Elektromagnitnogo Izlucheniya s Pomosshcy'yu Fazometrii", Rept. PR-286 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1976 p 1-21 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75545; PR-286) Avail: NTIS HC A02/MF A01 CSCL 20N

The possibility of localizing sources of electromagnetic radiation by measurement of the time of passage of the radiation or the measurement of its phase at various points of cosmic space, at which are located satellite observatories is examined. Algorithms are proposed for localization using two, three, and four astronomical observatories. The precision of the localization and several partial results of practical significance are deduced. J.M.S.

N78-32315*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Electrical Engineering.
MILLIMETER WAVE PROPAGATION MODELING OF INHOMOGENEOUS RAIN MEDIA FOR SATELLITE COMMUNICATIONS SYSTEMS
R. R. Persinger and W. L. Stutzman Jun. 1978 204 p refs (Contract NAS5-22577; Grant DAAG29-77-G-0083)
(NASA-CR-156817; IR-1978-1) Avail: NTIS HC A10/MF A01 CSCL 20N

A theoretical propagation model that represents the scattering properties of an inhomogeneous rain often found on a satellite communications link is presented. The model includes the scattering effects of an arbitrary distribution of particle type (rain or ice), particle shape, particle size, and particle orientation within a given rain cell. An associated rain propagation prediction program predicts attenuation, isolation and phase shift as a function of ground rain rate. A frequency independent synthetic storm algorithm is presented that models nonuniform rain rates present on a satellite link. Antenna effects are included along with a discussion of rain reciprocity. The model is verified using the latest available multiple frequency data from the CTS and COMSTAR satellites. The data covers a wide range of frequencies, elevation angles, and ground site locations. G.Y.

N78-32316*# Newsom (Bernard D.), Los Altos Hills, Calif.
RESEARCH PLAN FOR STUDY OF BIOLOGICAL AND ECOLOGICAL EFFECTS OF THE SOLAR POWER SATELLITE TRANSMISSION SYSTEM Final Report
Bernard D. Newsom Aug. 1978 361 p refs
(Contract NAS2-9655)
(NASA-CR-3044) Avail: NTIS HC A16/MF A01 CSCL 20N

A programmatic research plan for a three year study is presented to generate knowledge on effects of the continuous wave 2.45 GHz microwave power transmission that the Solar Power Satellite might have on biological and ecological elements, within and around the rectenna receiving site. Author

N78-32317*# National Aeronautics and Space Administration, Washington, D. C.
SOME REGULARITIES OF THE RADIOTHERMAL RADIATION EMITTED IN THE SYSTEM UNDERLYING SURFACE-ATMOSPHERE WITH CONVECTIVE CLOUDS
B. M. Vorobev and A. Baturina May 1977 12 p refs Transl. into ENGLISH from Tr. Gl. Geofiz Observ (Leningrad) no. 371 1976 p 66-73 Transl. by Transemantics, Inc., Washington D. C.
(Contract NASw-2792)
(NASA-TT-F-17536) Avail: NTIS HC A02/MF A01 CSCL 20N

Model calculations of radiothermal radiation are reported for a system with convection clouds that do not produce precipitation. The calculations are made in the wave band of 0.86 to 17 cm for the case of observation at the nadir of a smooth water surface and the surface of an absolutely black body. The vertical structure of convection clouds was taken into account in the numerical scheme (distribution was assigned with the height of temperature, water content and the phase state of the cloud). It is shown that for convection clouds with a high vertical thickness which develop over a smooth water surface, the relationship of the total brightness temperature of the system to wavelength has an extreme nature that is especially acutely expressed for crystallizing clouds. Author

N78-32318# Stanford Research Inst., Menlo Park, Calif.
A TRANSIONOSPHERIC COMMUNICATION CHANNEL MODEL Final Technical Report, 15 May - 15 Jul. 1977
Edward J. Fremouw, Anne R. Hessing, Charles L. Rino, and V. Elaine Hatfield Griffiss AFB, N. Y. RADC Apr. 1978 48 p refs
(Contract F30602-75-C-0236; ARPA Order 2777)
(AD-A055272; RADC-TR-78-88) Avail: NTIS HC A03/MF A01 CSCL 04/1

This report presents the final results of a three-year contract to develop a signal-statistical model of the transionospheric radio communication channel, building on a previously existing model for first-order signal statistics. The objectives of the contract work were as follows: (1) to test and improve the first-order statistical model; (2) to extend the model to second-order

statistical quantities in the temporal, spatial, and spectral domains; (3) to free the model from restriction to cases of weak, single scatter; and (4) to calibrate and iteratively test the morphological description of ionospheric structure that underlies the model. The foregoing objectives have been met, and the research results have been committed to two computer codes for performing systems-oriented, signal-statistical calculations. The more extensive of the two codes, IONSCNT, contains the morphological model and a two-component propagation routine that permits calculation of both focusing and diffractive-scatter effects. Mode 1 of IONSCNT provides calculation of intensity and phase scintillation indices and other first-order, signal-statistical parameters as functions of frequency, observing geometry, or other relevant variables from a user-selected set of ionospheric state parameters. Mode 2 of IONSCNT extends the Mode 1 results to second-order statistics for cases to be selected by the user. GRA

N78-32319# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
TARGET CLASSIFICATION BY TIME DOMAIN ANALYSIS OF RADAR SIGNATURES M.S. Thesis
Delbert Glenn Kulchak Dec. 1977 91 p refs
(AD-A055221; AFIT/GE/EE/77-25) Avail: NTIS HC A05/MF A01 CSCL 17/9

The purpose of this investigation is to examine a time domain pattern recognition algorithm which will identify targets by analysis of their radar signatures. The essence of the algorithm is a conversion of an analog waveform to a binary sequence, from which binary words are selected as attributes. The selection of attributes is a heuristic, nonexhaustive process, and each target is eventually described in a statistical sense by the frequency of occurrence of the binary attributes. A relationship between this Frequency of Occurrence of Binary Words method and the Fourier transform is also known. Author (GRA)

N78-32320# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN APPLICATION OF SYNCHRONIZED PSEUDO-RANDOM NOISE TO RADAR JAMMING M.S. Thesis
Fausto E. Molinet, Jr. Jan. 1978 102 p refs
(AD-A055225; AFIT/GE/EE/78-12) Avail: NTIS HC A06/MF A01 CSCL 17/4

In 1974 Doctor David W. Berrie of Aeronautical Systems Division, proposed a radar jamming waveform derived from filtered pseudo-random binary sequences. The running time of the sequence is synchronized to the pulse repetition rate of the victim radar and defeats the post detection pulse integrator. Berrie's results were derived from theory and analog computer simulation. This study applies that waveform to a radar receiver model incorporating a DICKE-FIX (wideband limiter) ECCM device and uses a digital computer simulation (RADSIM) to determine radar performance. Berrie's results were essentially confirmed, and the DICKE-FIX device was found to be ineffective against this form of jamming. Author (GRA)

N78-32321# Hughes Aircraft Co., Fullerton, Calif.
PORTABLE EARTH STATION ANTENNA STUDY SYSTEM Final Report
1 Mar. 1978 104 p Sponsored by Naval Res. Lab.
(AD-A054791; FR-78-14-287) Avail: NTIS HC A06/MF A01 CSCL 17/2

The Mobile Antenna System requirements should be satisfied by solutions which offer the best antenna system approach and provide the latest in the state-of-the-art technology with little or no risk. The antenna system should be very reliable yet cost effective. For the purpose of this study, only a single main reflector with a single beam system is considered. The recommended approach used to meet the requirements is the result of parametric tradeoffs of mechanical, electrical, logistic, reliability, and cost considerations. The recommended antenna system is a ten foot diameter parabolic reflector mounted on an ax-el pedestal that is tied to an erectable tower. The tower and the antenna assembly is mounted on a 26 foot flat bed that can be easily transported by C130 cargo plane. The erection mechanism is hydraulic and requires no special tools. Outriggers are provided for stabilizing the flat bed which becomes the pedestal for the tower. The system is designed for an antenna height of 25 feet. The feed is a center-fed cup dipole feed, the cup measuring approximately 9 inches in diameter and about 4 inches deep. The center support is a two-inch diameter lightweight pipe with a support cone at the attachment point of the reflector. The transmit and receive transmission lines plus a polarizing 90 degree hybrid are placed inside this support strut. The solid state transmitter, filters and preamplifier are all located directly behind the vertex of the reflector. Author (GRA)

N78-32322# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
PACKET BROADCAST BY SATELLITE. PLURIBUS SATELLITE IMP DEVELOPMENT. UNIX SYSTEM DEVELOPMENT, VOLUME 1 Quarterly Technical Report, 1 Feb. - 30 Apr. 1978
May 1978 71 p 2 Vol.
(Contracts MDA903-76-C-0214; MDA903-76-C-0252; ARPA Order 3186; ARPA Order 3214)
(AD-A055438; BBN-3824-Vol-1; QTR-9-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 17/2

This Quarterly Technical Report describes work on the development of and experimentation with packet broadcast by satellite, on development of a Transmission Control Program for UNIX and of PLURIBUS Satellite IMPs. Author (GRA)

N78-32323# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
PRIVATE LINE INTERFACE DEVELOPMENT. PACKET NETWORK SECURITY, VOLUME 2 Quarterly Technical Report, 1 Feb. - 30 Apr. 1978
May 1978 38 p 2 Vol.
(Contracts MDA903-76-C-0214; MDA903-76-C-0252; ARPA Order 3186)
(AD-A055439; BBN-3824-Vol-2; QTR-9-Vol-2) Avail: NTIS HC A03/MF A01 CSCL 17/2

This Quarterly Technical Report describes work on the development of a Private Line Interface and end-to-end packet network security. GRA

N78-32324# Army Missile Research and Development Command, Redstone Arsenal, Ala. Technology Lab.
MOMENT ESTIMATORS AND MAXIMUM LIKELIHOOD ESTIMATORS FOR THE RICIAN/LAHA'S BESSEL DISTRIBUTION: A COMPARATIVE STUDY
Latricha Greene and Jerry Vickers Feb. 1978 29 p refs
(AD-A055917; DRDMI-T-78-42) Avail: NTIS HC A03/MF A01 CSCL 17/9

This report presents approximations to standard errors of moment estimators for the parameters of the Rician distribution and Laha's Bessel distribution. The asymptotic properties of these estimators are investigated and compared to similar estimates using maximum likelihood techniques. Author (GRA)

N78-32325# Naval Research Lab., Washington, D. C.
A MULTIPLE RADAR INTEGRATED TRACKING (MERIT) PROGRAM Final Report
J. D. Wilson 3 Apr. 1978 27 p refs
(ZF12151001)
(AD-A055915; AD-E000162; NRL-8200) Avail: NTIS HC A03/MF A01 CSCL 17/9

A Multiple Radar Integrated Tracking (MERIT) FORTRAN program has been implemented on the ASC (Advanced Scientific Computer) at NRL. The program performs an automatic tracking function on data from one to five colocated radars with different radar parameters. The system will be used as a tool in evaluating various tracking concepts such as improved initiation, advanced correlation techniques, automatic radar control adverse environments, optimal realizable tracking filters, and software stabilization of 2D radars. In conjunction with the SURDET program to simulate the detector output of a radar, the tracking system can be used to evaluate proposed or existing radars in an automatic tracking role. Author (GRA)

N78-32326# Rome Air Development Center, Griffiss AFB, N.Y.
A FOLIAGE PENETRATION SUMMARY
August Golden Feb. 1978 29 p
(AD-A055391; RADC-TR-78-34) Avail: NTIS HC A03/MF A01 CSCL 17/9

A brief survey of existing data on foliage attenuation of RF energy is presented. It is shown that most researchers have

concluded from this data that RF energy is attenuated more rapidly in foliage at higher frequencies. Also, signal reflections from the foliage/air interface are shown to be a significant loss mechanism that is relatively frequency independent. Finally, curves for predicting RF signal reflection from and attenuation within foliage are presented. Author (GRA)

N78-32327# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
INTERACTION OF A SURFACE WAVE WITH A DIELECTRIC SLAB DISCONTINUITY
Steven A. Arcone and Allan J. Delaney Apr. 1978 19 p refs
(DA Proj. 4A1-61102-AT-24)
(AD-A055956; CRREL-78-8) Avail: NTIS HC A02/MF A01 CSCL 20/14

The interaction of a 5.1 GHz transverse electric surface wave with a dielectric slab is experimentally investigated. The wave is initially supported by a dielectric substrate resting upon a metallic ground-plane. A slab, made of the same dielectric material as the substrate and variable in height, is then placed upon the waveguide. The results for a small slab sitting on the substrate showed that the discontinuity was a very inefficient launcher of reflected surface waves. Investigations of these reflections with a trough waveguide showed that, for values of slab height comparable to the exponential decay height of the surface wave, the reflections remain very small. However, as the slab height is increased beyond the decay height, the reflected amplitude approaches the theoretical value for a plane wave reflected from the interface between air and the same dielectric. The results are applicable to surface wave methods of microwave deicing of wings and helicopter rotors. Author (GRA)

N78-32328# Army Military Center, Alexandria, Va.
X-SIM: A DYNAMIC COMMUNICATIONS SIMULATOR FOR THE X-TREE NETWORK REPORT AND USER'S MANUAL M.S. Thesis. Final Report
Paul Arthur Suhler 15 Jun. 1978 89 p refs
(AD-A055945) Avail: NTIS HC A05/MF A01 CSCL 09/2

This report introduces the virtual channel concept of interprocessor communications and describes the information needed to evaluate its performance in X-Tree. The requirements for a dynamic communications simulation are derived and an implementation is presented which simulates to the level of byte transmission and produces a trace output. An example statistics program is given which inputs the trace and outputs a statistical summary of selected performance indices for the network. A user's guide for the simulator is included as are sample simulation outputs. Author (GRA)

N78-32329# New Mexico State Univ., Las Cruces. Dept. of Electrical and Computer Engineering.
REAL-TIME VIDEO TRACKING CONCEPTS Interim Technical Report
G. M. Flachs, P. I. Perez, R. B. Rogers, S. J. Szymanski, and J. M. Taylor May 1978 71 p refs
(Grant DAAG29-76-G-0231)
(AD-A055394; ARO-13857.3-EL) Avail: NTIS HC A05/MF A01 CSCL 17/2

Real-time video (RTV) tracking concepts are developed for tracking high performance targets in noisy background scenes. Image processing techniques are combined with parallel processing methods to perform a statistical analysis of a TV image, partition the picture into target and background components, perform a structural analysis of the target image, and control the tracking optics to form an automatic tracking system. Author (GRA)

N78-32330# Arinc Research Corp., Annapolis, Md.
INVESTIGATION OF THE TECHNICAL AND OPERATIONAL FEASIBILITY OF USING A VHF DATA LINK FOR TRANSMISSION OF INTERMITTENT POSITIVE CONTROL (IPC), VOLUME 1 Final Report
S. H. Kowalski, E. R. Carbone, D. A. Swann, and K. F. Peter Aug. 1977 250 p
(Contract DOT-FA76WA-3788)
(AD-A055444; REPT-1326-21-01-1648-Vol-1) Avail: NTIS HC A11/MF A01 CSCL 01/2

This report presents the results of an investigation of using a VHF Data Link to transmit collision avoidance commands to aircraft operating in the National Air Space. Operational scenarios are developed and system capacity evaluations are performed to establish the operational feasibility of the concept. Identification of potential concepts considered feasible generated the design and cost development of the avionics required in support of the prepared operation of IPC on a VHF Data Link. Author (GRA)

N78-32331# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
VERY LOW FREQUENCY PROPAGATION IN THE EARTH'S CRUST BELOW THE OCEAN M.S. Thesis
Ruth B. Kaplan Dec. 1977 117 p refs
(AD-A055634; AFIT/GEP/EE/77-1) Avail: NTIS HC A06/MF A01 CSCL 20/14

The feasibility of using the earth's crust under the oceans as a communications channel for very low frequency waves was studied. The structure of the crust and its electrical properties were used to evaluate the conductivity-depth profiles found in the literature. Using the impedance, E sub x/H sub y, a new phase function was defined that not only made the phase changes at the boundaries of the waveguide explicit, but also allowed the use of a computer for calculation of the propagation and attenuation constants. The system noise was assumed to come from two main sources: atmospherics and thermal effects. Calculation showed that beneath the ocean the atmospheric noise could be neglected. The thermal noise within the waveguide was calculated to be -162 dBm. The attenuation for the TM sub 10 mode was calculated to be -1.35 dB/km, thus allowing a transmission range of only about 163 km for 1 kW of transmitted power. The conclusion was that the crust under the ocean was not feasible as a long-range communications channel at VLF for the TM sub 10 mode. GRA

N78-32332# Army Electronic Proving Ground, Fort Huachuca, Ariz.
NOISE AND ITS RELATIONSHIP TO VEHICLE ELECTROMAGNETIC EMISSIONS: FEASIBILITY STUDY
Jun. 1978 179 p refs
(AD-A055674; USAEPG-FR-1065) Avail: NTIS HC A09/MF A01 CSCL 17/2

This report presents the results of a feasibility study of noise and its relationship to vehicle electromagnetic emissions and the resultant effects on communication system performance. Previous efforts in this field are summarized through a series of matrices which identify the advantages, disadvantages, and status of specific noise parameters or models and communication system performance models. The report also identifies areas for future work. Author (GRA)

N78-32333# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
RF POWER OUTPUT (AM-FM-SSB) NON-PULSED Test Operations Procedure
20 Apr. 1978 10 p
(AD-A055798; TOP-6-2-558) Avail: NTIS HC A02/MF A01 CSCL 14/2

The methodology and procedures are given for determining non-pulsed, radio frequency, output power. They are adaptable to any power level, can be used in shielded enclosures or in the field, and adapted to arctic, desert, temperate or tropic zones. Instrumentation, data collection and analysis are delineated. Author (GRA)

N78-32334# California Inst. of Tech., Pasadena. Dept. of Applied Mathematics.
A NUMERICAL AND THEORETICAL STUDY OF CERTAIN NONLINEAR WAVE PHENOMENA Progress Report
B. Fornberg and G. B. Whitham 30 Aug. 1977 38 p refs
Repr. from Transactions of the Royal Soc. of London. A: Mathematical and Physical Sci. (London), v. 2 89, no. 1361, 2 May 1978 p 373-404
(Contract N00014-75-C-0702)
(AD-A055737) Avail: NTIS HC A03/MF A01 CSCL 12/1

An efficient numerical method was developed for solving nonlinear wave equations typified by the Korteweg-de Vries equation and its generalizations. The method used a pseudospectral (Fourier transform) treatment of the space dependence

together with a leap-frog scheme in time. It was combined with theoretical discussions in the study of a variety of problems including solitary wave interactions, wave breaking, the resolution of initial steps and wells, and the development of nonlinear wavetrain instabilities. Author

N78-32335# Sandia Labs., Albuquerque, N. Mex.
DISRUPTION OF SATELLITE-TO-GROUND STATION COMMUNICATION LINKS BY NUCLEAR FIREBALLS
T. D. Sullivan Oct. 1977 18 p refs
(Contract EY-76-C-04-0789)
(SAND-77-0927) Avail: NTIS HC A02/MF A01

Diffraction around nuclear fireballs near the line of sight for satellite-to-ground communication links is calculated numerically. The geometry allows assumption of geometric optics and plane-wave signals. The fireball is modeled as an opaque disk normal to the line of sight. The effect of disk shape and edge taper is considered. ERA

N78-32336# National Technical Information Service, Springfield, Va.
ELECTROMAGNETIC SHIELDING, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Final Report, 1972 - Apr. 1978
William E. Reed Jun. 1978 249 p Supersedes NTIS/PS-77/0482; NTIS/PS-76/0366; NTIS/PS-75/367
(NTIS/PS-78/0524/5; NTIS/PS-77/0482; NTIS/PS-76/0366; NTIS/PS-75/367) Avail: NTIS HC $28.00/MF $28.00 CSCL 09C

This bibliography presents 343 abstracts. Research on electromagnetic shielding of electronic and electrical equipment, personnel, and ordnance is covered along with the shielding effectiveness of materials and structures. Nuclear electromagnetic pulse shielding is included. GRA

N78-32337# Office of Telecommunications, Boulder, Colo. Inst. for Telecommunication Sciences.
SOME INFLUENCES OF RAINFALL ON SATELLITE/GROUND MICROWAVE SYSTEM INSTALLATION COSTS
E. J. Dutton Mar. 1978 37 p refs
(PB-280727/9; OTR-78-142) Avail: NTIS HC A03/MF A01 CSCL 17B

The cost of installation of antennas at a proposed earth station site will likely be increased because of the larger sizes and powers needed to combat the degradation effects of transmission through storms. An attempt is made here to assess some of these costs based on data and modeling of storms. An attempt is also made to briefly analyze the cost effectiveness of site diversity as a solution to the problem of storm degradation. It becomes apparent that the use of site diversity involves a major tradeoff between transmission-reception availability and added cost. GRA

N78-32135# Indian Inst. of Science, Bangalore. Space Segment Project Office.
SATELLITE COMMUNICATIONS
M. K. Saha *In its* Space Sci., Technol. and Appl.: An Overview Apr. 1978 17 p (For primary document see N78-32114 23-12) Avail: NTIS HC A10/MF A01

N78-32144*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ON IMPROVED RANGING
J. W. Layland, A. I. Zygielbaum, and W. P. Hubbard *In its* The Deep Space Network 15 Aug. 1978 p 40-44 refs (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 20N

N78-32146*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
JPL 2-TO-THE-20TH-POWER CHANNEL 300 MHz BANDWIDTH DIGITAL SPECTRUM ANALYZER
G. A. Morris, Jr. and H. C. Wilck *In its* The Deep Space Network 15 Aug. 1978 p 57-61 refs (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 20N

N78-32156*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DSS RADIO SCIENCE SUBSYSTEM: DATA HANDLING OF VERY LONG BASELINE INTERFEROMETRY (VLBI) DATA
A. L. Berman *In its* The Deep Space Network 15 Aug. 1978 p 115-122 ref (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 17B

N78-32157*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ABSOLUTE FLUX DENSITY CALIBRATIONS: RECEIVER SATURATION EFFECTS
A. J. Freiley, J. E. Ohlson (Naval Postgraduate School), and B. L. Seidel *In its* The Deep Space Network 15 Aug. 1978 p 123-129 refs (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 17B

N78-33019# Joint Publications Research Service, Arlington, Va.
EARTH-TO-ORBITAL STATION RADIO BRIDGE
B. Pokrovskiy *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 42 (JPRS-71612) 3 Aug. 1978 p 61-67 Transl. into ENGLISH from Aviat. Kosmonavt. (Moscow), no. 6, 1978 p 38-39 (For primary document see N78-33015 23-99)
Copyright. Avail: NTIS HC A05/MF A01

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N78-32338* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
QUADRAPHASE DEMODULATION Patent
Carl R. Ryan, inventor (to NASA) (Motorola, Inc., Scottsdale, Ariz.) Issued 30 May 1978 6 p Filed 21 Jun. 1977 Supersedes N77-27272 (15 - 18, p 2372) Sponsored by NASA
(NASA-Case-GSC-12137-1; US-Patent-4,092,606;
US-Patent-Appl-SN-808510; US-Patent-Class-329-124;
US-Patent-Class-331-4; US-Patent-Class-331-12;
US-Patent-Class-331-64) Avail: US Patent Office CSCL 09C

A received, suppressed carrier, quadraphase shift key modulated (QPSK)signal is demodulated with a phase locked loop including a variable frequency, coherent reference that drives first and second channels also responsive to the QPSK signal. The channels respectively derive first and second replicas of binary signals that modulated the suppressed carrier. The replicas are combined to derive a variable amplitude error signal for controlling the coherent reference frequency. The frequency of the coherent reference is dithered at a low rate so that there is derived a relatively low level tracking error phase from the locked loop. The frequency of the coherent reference is swept when the phase of the error signal differs from the dithering phase by a predetermined value that is appreciably less than 90 degrees.
Official Gazette of the U.S. Patent Office

N78-32339* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LOGARITHMIC CIRCUIT WITH WIDE DYNAMIC RANGE Patent
Paris H. Wiley (Va. Polytechnic Inst. and State Univ.) and Eugene A. Manus, inventors (to NASA) (Va. Polytechnic Inst. and State Univ.) Issued 23 May 1978 5 p Filed 16 Feb. 1977 Supersedes N77-19319 (15 - 10, p. 1301) Sponsored by NASA
(NASA-Case-GSC-12145-1; US-Patent-4,091,329;
US-Patent-Appl-SN-769149; US-Patent-Class-328-145;
US-Patent-Class-307-229; US-Patent-Class-307-230) Avail: US Patent Office CSCL 09C

A circuit deriving an output voltage that is proportional to the logarithm of a dc input voltage susceptible to wide variations in amplitude includes a constant current source which forward biases a diode so that the diode operates in the exponential portion of its voltage versus current characteristic, above its saturation current. The constant current source includes first and second, cascaded feedback, dc operational amplifiers connected

in negative feedback circuit. An input terminal of the first amplifier is responsive to the input voltage. A circuit shunting the first amplifier output terminal includes a resistor in series with the diode. The voltage across the resistor is sensed at the input of the second dc operational feedback amplifier. The current flowing through the resistor is proportional to the input voltage over the wide range of variations in amplitude of the input voltage.

Official Gazette of the U.S. Patent Office

N78-32340* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

WIDE POWER RANGE MICROWAVE FEEDBACK CONTROLLER Patent

Leo E. Titus, inventor (to NASA) (Hughes Aircraft Co.) Issued 30 May 1978 6 p Filed 29 Mar. 1977 Supersedes N77-21322 (115 - 12, p. 1577) Sponsored by NASA

(NASA-Case-GSC-12146-1; US-Patent-4,092,617; US-Patent-Appl-SN-782480; US-Patent-Class-333-17R; US-Patent-Class-325-159; US-Patent-Class-325-187; US-Patent-Class-333-81R) Avail: US Patent Office CSCL 09C

A substantially constant power level is derived over a predetermined frequency band, in each of a plurality of relatively widely spaced power ranges, from a microwave load having a predetermined amplitude versus frequency response, such as an antenna. A microwave source of substantially constant amplitude drives a forward path connected between the source and the load. A feedback path responsive to the microwave power level in the forward path derives a control voltage for the PIN attenuator. The equalizer attenuator drives a linear, crystal amplitude detector. Attenuating means included in the forward and feedback paths are selectively connected in circuit to maintain the power level of the microwave input to the amplitude detector substantially constant, even though different power ranges are supplied to the load by the forward path.

Official Gazette of the U.S. Patent Office

N78-32341* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

REGULATED HIGH EFFICIENCY, LIGHTWEIGHT CAPACITOR-DIODE MULTIPLIER dc TO dc CONVERTER Patent

William T. Harrigill, Jr. and Ira T. Myers, inventors (to NASA) Issued 30 May 1978 5 p Filed 27 May 1977 Supersedes N77-24385 (15 - 15, p 2011)

(NASA-Case-Lew-12791-1; US-Patent-4,092,712; US-Patent-Appl-SN-801432; US-Patent-Class-363-60; US-Patent-Class-363-16; US-Patent-Class-363-101) Avail: US Patent Office CSCL 09C

A voltage multiplier having a capacitor-diode voltage multiplying network is disclosed which is fed with voltage pulses from a dc source through a first switching means. Pulses of a second polarity are also supplied through a second switching means to the input of the capacitor-diode voltage multiplier from a second dc source whose voltage is adjustable to change the voltage of the pulses of second polarity. The switching means are alternately rendered conducting by signals from a control circuit. The second dc source may be controlled by a voltage comparator which compares the output voltage of the capacitor-diode voltage multiplier to the reference source.

Official Gazette of the U.S. Patent Office

N78-32342 Purdue Univ., Lafayette, Ind.

MIXED CONDUCTIVITY IN IRON DOPED BETA ALUMINA Ph.D. Thesis

James Phillip Roland 1977 176 p

Avail: Univ. Microfilms Order No. 7813112

Iron was chosen as a likely transition metal candidate to promote electronic motion in the spinel blocks of beta alumina. A composition typical of the beta structure was chosen (Na_2O-6.27-Al_2O_3), and the limit of iron which resulted in a single phase beta structure was determined. In the best case, over 70% of the aluminum atoms in the spinel block were replaced with iron while retaining the beta structure. Based on a simple, non-interactive model for conduction, only a 53% substitution is necessary to impart equal ionic and electronic components to the conductivity. Dissert. Abstr.

N78-32343 George Washington Univ., Washington, D. C.

MATHEMATICAL TECHNIQUES FOR BEAM-WAVEGUIDE COUPLERS Ph.D. Thesis

Michael Richard Hudson Hugger 1978 400 p

Avail: Univ. Microfilms Order No. 7812967

Systematic mathematical techniques are developed for problems in integrated optics and their specific application to beam-waveguide couplers. Obtaining full-wave solutions to the prism and grating couplers provides complete descriptions of their operation. The prism coupler problem is solved through the use of the complex-source-point technique, in which the source point of the appropriate Green's function is analytically continued into complex space, thus generating the solutions to a Gaussian beam excitation. It is shown with only two steps a complete solution is obtained to the fields in the prism and film. The input and output grating coupler problems are solved using full wave techniques and coupled mode theory. Expressions are developed for the guided wave and radiation fields in both the single-beam input and output couplers. Dissert. Abstr.

N78-32344* National Aeronautics and Space Administration, Washington, D. C.

CALCULATION OF ELECTROSTATIC FIELDS IN PERIODIC STRUCTURES OF COMPLEX SHAPE

V. F. Kravchenko Oct. 1978 15 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radioelektron. (USSR), v. 20, Oct. 1977 p 3-11 Transl. by SCITRAN, Santa Barbara, Calif. (NASA-TM-75462) Copyright. Avail: NTIS HC A02/MF A01 CSCL 09C

A universal algorithm is presented for calculating electrostatic fields in an infinite periodic structure consisting of electrodes of arbitrary shape which are located in mirror-symmetrical manner along the axis of electron-beam propagation. The method is based on the theory of R-functions, and the differential operators which are derived on the basis of the functions. Numerical results are presented and the accuracy of the results is examined. G.G.

N78-32345*# Ohio Univ., Athens. Dept. of Electrical Engineering.

PREAMPLIFIER NOISE IN VLF RECEIVERS

Ralph W. Burhans Sep. 1978 6 p refs

(Grant NGR-36-009-017)

(NASA-CR-157726; TM-62) Avail: NTIS HC A02/MF A01 CSCL 09C

Noise specifications for junction field-effect transistors are presented in different ways depending on the particular semiconductor manufacturer. Arithmetic involved in converting these specifications to equivalent RMS noise in microvolts developed at the preamplifier input terminal is reviewed. These methods were useful for estimating the noise performance of high input impedance preamplifiers used with E-field antennas operating in the range of 1 KHz to 10 MHz. Both the JFET MPF-102 transistor and the COS/MOS CA3600 transistor array provided amplification for VLF receivers where the internally generated noise was well below the atmospheric noise level. The CA3600 transistor array provided better performance because of the more symmetrical complementary MOS transistor transfer characteristics than a single N-type biased JFET transistor. The CMOS amplifier resulted in self-compensating gain characteristics over a very wide temperature range from -55 to +125 C. J.A.M.

N78-32346*# National Aeronautics and Space Administration, Washington, D. C.

ELECTRONIC MEASUREMENT OF VARIABLE TORQUES IN PRECISION WORK TECHNOLOGY

M. Maehr Sep. 1978 17 p refs Transl. into ENGLISH from Arch. Tech. Messen (West Germany), Apr. 1972 p 61-66 Original language document was announced as A72-30485 Transl. by SCITRAN, Santa Barbara, Calif. Original doc. prep. by Technischen Hochschule Wien

(Contract NASw-3198)

(NASA-TM-75455) Avail: NTIS HC A02/MF A01 CSCL 09C

Approaches for the determination of torques on the basis of length measurements are discussed. Attention is given to torque determinations in which the deformation of a shaft is measured, an electric measurement of the torsion angle, and an approach proposed by Buschmann (1970). Methods for a torque determination conducted with the aid of force measurements

make use of piezoelectric approaches. The components used by these methods include a quartz crystal and a charge amplifier.
Author

N78-32347*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MICROWAVE INTEGRATED CIRCUIT FOR JOSEPHSON VOLTAGE STANDARDS Patent Application
Louis B. Holdeman (NBS, Washington, D. C.), Jaan Toots (NBS, Washington, D. C.), and Chu-Cheng Chang, inventors (to NASA) (NBS, Washington, D. C.) Filed 31 Aug. 1978 21 p Sponsored by NASA
(NASA-Case-MFS-23845-1; US-Patent-Appl-SN-938298) Avail: NTIS HC A02/MF A01 CSCL 09C

An invention is presented which relates to voltage standards wherein a precise voltage is obtained by observation of the voltage-current characteristics of a Josephson junction, a cross which is applied a microwave signal of a precisely known frequency. The novelty of the invention lies in simplifying the structure significantly wherein a single junction is employed and a quite simple biasing system employed with it. NASA

N78-32348# Duke Univ., Durham, N. C. Dept. of Electrical Engineering.
A COMPARISON OF TWO NOISE CANCELING SYSTEM ALGORITHMS M.S. Thesis
Rachel Patricia Messina Dec. 1977 139 p refs
(Contract N00014-75-C-0191)
(AD-A055822; TR-14) Avail: NTIS HC A07/MF A01 CSCL 09/3

The purpose of this study is to compare two noise canceling system algorithms when the number of inputs to the system is small. The expected value algorithm is an estimate of the optimum solution for minimum mean square error analysis. The LMS (least mean square) algorithm was developed to avoid the matrix inversion inherent in the optimum solution given by the Wiener-Hopf equation. The comparison between the two algorithms is measured by the rate of convergence of the mean square error and the minimum error after five hundred iterations. A computer simulation of a dc signal in Gaussian noise provided the comparison between the two algorithms. The tradeoff in terms of performance for simplicity in the LMS algorithm was discovered to be great. The expected value algorithm consistently produced better results in terms of faster rates of convergence and smaller minimum errors after five hundred iterations. GRA

N78-32349# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THE STATIC CHARACTERIZATION OF MAGNETIC BUBBLE FILMS USING SPATIAL FILTERING TECHNIQUES M.S. Thesis
Robert Ashley McDonald Dec. 1977 116 p refs
(AD-A055687; AFIT/GE/EE/77-27) Avail: NTIS HC A06/MF A01 CSCL 09/2

The primary objectives of this study were to confirm the spatial filtering technique for the static characterization of 4 to 7 micrometers stripewidth magnetic bubble films, and to extend the technique to 1 to 3 micrometers stripewidth films. Also an objective was to determine the uncertainty in 4(pi)M(s) value if infinite Q is assumed, when in fact a more modest value (3-Q-5) is present. The spatial filtering technique used the diffraction grating properties of a magnetic bubble film in conjunction with the equation of Kooy and Enz to determine stripewidth, characteristic length, and saturation magnetization. The spatial filter removes unwanted orders from the diffraction pattern. The filtered signal is focused on a photodetector and the first order diffraction angle measured to find stripewidth and the second order to find saturation magnetization. The Kooy and Enz equation were computer programmed and tables and plots of characteristic length/thickness and applied field/saturation magnetization prepared. GRA

N78-32350# Radio Corp. of America, Lancaster, Pa. SSD-Electro-Optics and Devices.
MANUFACTURING METHODS AND TECHNOLOGY (MM AND T) MEASURE FOR FABRICATION OF SILICON TRANSCALENT THYRISTOR Quarterly Report, 1 Jan. - 31 Mar. 1978
B. B. Adams, S. W. Kessler, R. E. Reed, and D. R. Trout Apr. 1978 56 p
(Contract DAAB07-76-C-8120)
(AD-A055499; QR-6) Avail: NTIS HC A04/MF A01 CSCL 09/1

This Sixth Quarterly Report describes the progress on the MM and TE program for Transcalent (Heat-Pipe cooled) thyristors. Production engineering measures for the device and the pertinent state-of-the-art on the sample devices are included. Test results on all the confirmatory samples are listed. The present status includes the submission of the confirmatory samples, the fabrication of the confirmatory sample devices, the engineering analyses of the final test results on these devices, and the equipment refinements being procured for this program. Plans for the next Quarter are the preparations and fabrication of devices for the pilot run phase. Author (GRA)

N78-32351# Microwave Associates, Inc., Burlington, Mass.
MANUFACTURING METHODS AND TECHNOLOGY PROGRAM FOR THE ESTABLISHMENT OF PRODUCTION TECHNIQUES AND THE PILOT PRODUCTION OF A HIGH EFFICIENCY, HIGH POWER GaAs READ-TYPE IMPATT DIODE Quarterly Report, 1 Jul. - 31 Sep. 1977
Robert E. Walline and John L. Heaton Oct. 1977 42 p
(Contract DAAB07-77-C-0324)
(AD-A055669; ECOM-0324-3; QR-3) Avail: NTIS HC A03/MF A01 CSCL 09/1

The purpose of this program is the establishment and verification of techniques to reduce the labor and increase control of processes used in the preparation of epitaxial GaAs and subsequent fabrication of Read-type, Low-High-Low (LHL) GaAs IMPATT diodes. The reduced labor and increased control will be demonstrated by improved manufacturing yields at reduced manufacturing cost. The mechanism by which these improvements are to be obtained is the automation of the epitaxial crystal growth process with appropriate feedback mechanisms which will regulate process variables in accordance with actual conditions. The system is required to control and respond rapidly to variation in wafer temperature, exposure time of the wafer to this temperature, the flow rate of the dopant and epitaxial gases, the chemical composition of these gases and the interrelationship of all these factors. In addition, the epitaxial crystal evaluation (routine) will be eliminated and crystal evaluation (non-routine) will be reduced. The engineering effort will be restricted to the epitaxial crystal growth and epitaxial crystal evaluation required to produce high-efficiency, Read-type IMPATT diodes plus sample diodes to demonstrate the progress. GRA

N78-32352# ARO, Inc., Arnold Air Force Station, Tenn.
AUTOMATIC DATA ACQUISITION SYSTEM FOR AN LED TEST Final Report, Apr. 1976 - Sep. 1977
Zeni Batte AEDC Jun. 1978 44 p refs
(AD-A055872; AEDC-TR-77-1) Avail: NTIS HC A03/MF A01 CSCL 09/1

The object of the work performed was to develop a computer controlled data acquisition and data analysis capability for an uninterrupted 6,000 hour test to monitor the degradation of approximately 250 infrared light emitting diodes (LED's). The test program comprised subjecting a sampling of 254 diodes to preselected constant currents and temperatures while periodically measuring the voltage drop and the light output of each of the diodes. To perform the data acquisition portion of this effort, an automated data acquisition system was designed around a Hewlett-Packard 2100A computer. This system utilized a 1,000 point random access multiplever, a 16 bit Relay Output Register and a digital voltmeter for data acquisition and transmission. Special purpose assembly language input/output routines were written for the computer's BASIC Interpreter to make this special equipment accessible to the computer. The Control program handled data storage to meet the requirements specified for the project. Author (GRA)

N78-32353# Rockwell International Corp., Anaheim, Calif. Electronics Research Center.
ELASTIC WAVE TRANSDUCERS FOR GARNET FIBERS Final Technical Report, 21 Sep. 1976 - 30 Sep. 1977
D. B. Anderson, R. R. August, and J. E. Coker 30 Sep. 1977 21 p refs

(Contract N00173-76-C-0315)
(AD-A055749; C77-329/501) Avail: NTIS HC A02/MF A01 CSCL 09/1

The results of an effort to fabricate elastic wave transducers for use on the end of garnet fibers is reported herein. Essential properties for the materials under consideration, namely, fibers and piezoelectric transducers, are included as background together with exposition pertaining to the various types of modes which may be propagated as elastic waves along cylindrical fibers. The transducer design approach considered is described. Observations are noted for the gadolinium gallium garnet fibers supplied via NRL from another contractor. The fibers supplied represent a new crystal growth technology which exhibit various kinds of defects which prevented their use. This report documents the various problems encountered. Author (GRA)

N78-32354# North Carolina State Univ., Raleigh. Dept. of Electrical Engineering.
INVERSION AND ACCUMULATION LAYER FORMATION AT ELEVATED TEMPERATURES IN nGaAs-ANODIC OXIDE MIS DEVICES Final Report, 1 Apr. 1975 - 31 Dec. 1977
M. A. Littlejohn, Horst R. Wittmann, S. Varadarajan, and J. R. Hauser 2 May 1978 19 p refs
(DAHC04-75-G-0134; DAAG29-76-G-0225)
(AD-A056142; ARO-13160.1-EL; ARO-14297.1-EL) Avail: NTIS HC A02/MF A01 CSCL 09/1

At room temperature nGaAs-anodic oxide MIS devices typically exhibit some form of deep-depletion mode operation which is characteristic of a low thermal generation rate for minority carriers in the semiconductor. In addition, for accumulation mode bias voltages the small signal capacitance often does not approach the oxide capacitance, instead exhibiting a dispersion whereby this capacitance varies with the frequency of the a-c signal and the sweep-rate of the d-c bias voltage. In this paper, capacitance-voltage measurements are reported for nGaAs-anodic oxide MIS devices taken at elevated temperatures with varying d-c bias voltage sweep rates. The formation of a stable inversion layer even at high sweep rates and the elimination of accumulation capacitance dispersion for a C-V measurement frequency of up to 1 MHz is observed at temperatures above room temperature. At high temperatures and slow sweep-rates, considerable mobile ion motion in the oxide is observed. A discussion of this observation based on recently developed theories for oxide growth is presented. Author (GRA)

N78-32355# Bendix Corp., Kansas City, Mo.
STRESS RELIEF TECHNIQUES FOR REDUCING THERMAL FATIGUE IN SOLDER JOINTS
D. M. Jarboe Feb. 1978 33 p refs Revised
(Contract EY-76-C-04-0613)
(BDX-613-1655-Rev) Avail: NTIS HC A03/MF A01

The most effective method for relieving stress on foam encapsulated solder joints caused by thermal cycling is using silicone sleeving over component lead wires. The use of 128 kg/cu m polyurethane foam rather than 320 kg/m cu m foam was advantageous only when the component leads were not sleeved. Special lead configurations were no better than a standard 90 degree bend. ERA

N78-32356# Sandia Labs., Albuquerque, N. Mex.
IMPULSE FROM AN ELECTRICALLY EXPLODED ETCHED COOPER MESH
Billy W. Duggin, M. J. Forrestal, and R. I. Butler Mar. 1978 11 p refs
(Contract EY-76-C-04-0789)
(SAND-78-0387) Avail: NTIS HC A02/MF A01

An impulse simulation technique for radiation-induced material blowoff on layers internal to reentry body shell structures was explored. Etched copper mesh patterns were exploded with current from a capacitor discharge. Impulse intensities between 100 and 500 Pa.s (1000 and 5000 taps) were produced on a simulated shell structure which was separated from the mesh by a 1.25 mm (0.05 in.) air gap. ERA

N78-32357# Oak Ridge Y-12 Plant, Tenn.
METHODS OF CALCULATING ERRORS IN PRECISION RECTIFIER CIRCUITS
Michael G. Duncan 26 Sep. 1977 41 p refs Presented at IEEE Symp. on Circuits and Systems, New York, 17 May 1978
(Contract W-7405-eng-26)
(Y/DA-7474; Conf-780518-1) Avail: NTIS HC A03/MF A01

Diodes are used as rectifiers, but due to forward voltage drop, accuracy is poor. Three methods of computer rectifier error based on exponential models of the PN junction current-voltage characteristics are presented. An iterative hand analysis provides accurate prediction of rectifier performance at midband frequencies. To include frequency dependence, slewrate and other nonlinear characteristics, CSMP system models or nonlinear differential equation methods can be used. ERA

N78-32358# Mechanical Technology, Inc., Latham, N. Y.
ADVANCED ELECTRIC MOTOR-TRANSMISSION FOR ELECTRIC VEHICLES, DEVELOPMENT PLAN
A. Marcus Nov. 1977 59 p refs
(Contract EY-76-C-02-2835)
(COO-2835-3; MTI-78TR4) Avail: NTIS HC A04/MF A01

A plan of action is presented to design, fabricate, and test on all-electric motor transmission system for an electric powered vehicle. Topics discussed include: (1) a program plan for development of an electric motor transmission; (2) statement of work and general approach; (3) technical discussion; and (4) program organization. The program proposes to demonstrate, by means of a full sized laboratory model, the capability of a highly efficient all-electric variable ratio electric motor transmission. The development plan presents the demonstration portion of program which reduced the concept to practice and characterized the system operation, performance, and capability for an advanced electric vehicle propulsion system. ERA

N78-32359# National Technical Information Service, Springfield, Va.
ELECTRIC POWER CONSUMPTION, VOLUME 1. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1971 - 1976
Audrey S. Hundemann Jun. 1978 247 p
(NTIS/PS-78/0644/1) Avail: NTIS HC $28.00/MF $28.00 CSCL 10B

A bibliography containing 241 abstracts concerning industrial, commercial, and residential aspects of electric power consumption and demand are presented. Topic areas cover the economics of supply as well as amount of consumption. GRA

N78-32360# National Technical Information Service, Springfield, Va.
ELECTRIC POWER CONSUMPTION, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1977 - Jun. 1978
Audrey S. Hundemann Jun. 1978 127 p Supersedes NTIS/PS-77/0546; NTIS/PS-76/0476; NTIS/PS-75/368
(NTIS/PS-78/0645/8; NTIS/PS-77/0546; NTIS/PS-76/0476; NTIS/PS-75/368) Avail: NTIS HC $28.00/MF $28.00 CSCL 10B

A bibliography containing 121 abstracts concerning industrial, commercial, and residential aspects of electric power consumption and demand are presented. Topic areas cover the economics of supply as well as amount of consumption. GRA

N78-32361# National Technical Information Service, Springfield, Va.
ELECTRIC POWER CONSUMPTION CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Jun. 1978
Audrey S. Hundemann Jun. 1978 236 p Supersedes NTIS/PS-77/0547; NTIS/PS-76/0477
(NTIS/PS-78/0646/6; NTIS/PS-77/0547; NTIS/PS-76/0477) Avail: NTIS HC $28.00/MF $28.00 CSCL 10B

Citations from worldwide research on electric power consumption in the commercial, residential, and industrial sectors of the U.S. and many foreign countries are presented. Topic areas cover methods of forecasting electric power demand, computerized load control, and trends in electric power consumption. A few abstracts pertain to the economics of supply and conservation measures. GRA

N78-32362# National Technical Information Service, Springfield, Va.

BEAM LEAD MICROELECTRONICS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Mar. 1978
William E. Reed Apr. 1978 83 p Supersedes NTIS/PS-77/0361; NTIS/PS-76/0348; NTIS/PS-75/246 (NTIS/PS-78/0368/7; NTIS/PS-77/0361; NTIS/PS-76/0348; NTIS/PS-75/246) Avail: NTIS HC $28.00/MF $28.00 CSCL 09E

The technology and application of beam lead devices are treated in these Federally-sponsored research reports. Topics include design, fabrication, bonding, packaging, testing, and radiation hardening. GRA

N78-32130# Indian Space Research Organization, Bangalore. Satellite Center.
SPACECRAFT ELECTRONIC SYSTEMS, 1
R. Ashiya *In* Indian Inst. of Sci. Space Sci., Technol. and Appl.: An Overview Apr. 1978 14 p (For primary document see N78-32114 23-12)
Avail: NTIS HC A10/MF A01

N78-32149*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSS 13 ANTENNA SUBSYSTEM AUTOMATION
H. Phillips, I. Crane, and P. Lipsius *In its* The Deep Space Network 15 Aug. 1978 p 73-75 (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 09C

N78-32155*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PRELIMINARY ANALYSIS OF THE IMPACT OF POWER CYCLING ON CTA-21 EQUIPMENT RELIABILITY
E. R. Cole *In its* The Deep Space Network 15 Aug. 1978 p 109-114 refs (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 09C

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N78-32363 California Univ., Berkeley.
NUMERICAL STUDY OF INCOMPRESSIBLE FLOW IN A REGION BOUNDED BY ELASTIC WALLS Ph.D. Thesis
Raul Hernan Mendez 1977 121 p
Avail: Univ. Microfilms Order No. 78-12684

A grid-free method for computing the flow of an incompressible inviscid fluid surrounded by elastic walls is introduced. The boundary is assumed to exert forces on the fluid and to move at the local fluid velocity. The crux of the method of solution is the representation of point forces by discrete vortex dipoles. Peskin's algorithm is used to compute the forces exerted by the boundary on the fluid: from the state of the boundary a set of point forces is obtained via a link formalism. The major accomplishment of the method is the replacement of each point force by a vortex dipole with axis length and vortex intensity set so that the vortex dipole imparts to the fluid precisely the amount of momentum transmitted by the point force. Euler's equations are then integrated; the accumulated vorticity at the boundary determines the fluid velocity everywhere. Dissert. Abstr.

N78-32364 California Univ., Berkeley.
STATISTICAL STUDY OF APPROXIMATIONS TO TWO DIMENSIONAL INVISCID TURBULENCE Ph.D. Thesis
Harland Mitchell Glaz 1977 118 p
Avail: Univ. Microfilms Order No. 78-12576

A numerical technique is developed for studying the ergodic and mixing hypothesis for the dynamical systems arising from the truncated Fourier transformed two-dimensional inviscid Navier-Stokes equations. Two arguments which can explain macroscopic vortices are presented. The first is statistical mechanical. The second argument is dynamical in nature; it hypothesizes either a flow invariant set around the macroscopic vortices or that the set of macroscopic vortices is an attractor for the flow. Both cases require nonergodicity of the underlying flow. It is shown, however, that these arguments are logically flawed in the inviscid case because of violations of the conservation of measure. Dissert. Abstr.

N78-32365 Johns Hopkins Univ., Baltimore, Md.
STABILITY OF RIMMING FLOWS Ph.D. Thesis
Moses Andreas Boudourides 1978 143 p
Avail: Univ. Microfilms Order No. 78-11764

Necessary and sufficient conditions for the stability of the inviscid profile, subject to infinitesimal axisymmetric disturbances were studied. A generalization of Rayleigh's criterion was found, taking into account the presence of an interface. Centrifugally stable profiles could be destabilized through a combination of capillary and Rayleigh-Taylor effects on the interface. As for the viscous profile, rigid body rotation, a sufficient condition was established for its stability to infinitesimal axisymmetric disturbances (a generalization of Synge's criterion). This turned out to be the stability condition of the generalized Rayleigh's criterion applied to the viscous profile. Viscosity did not destabilize the flow. The characteristic equation was derived for the instability of the rigid body rotation for some limiting cases. Dissert. Abstr.

N78-32366 Rensselaer Polytechnic Inst., Troy, N. Y.
STABILITY OF PLANE POISEUILLE FLOW AND PLANE COUETTE FLOW Ph.D. Thesis
Thomas Lee Cheng 1977 152 p
Avail: Univ. Microfilms Order No. 78-11530

The stability of plane Poiseuille flow of an incompressible viscous fluid between a rigid plate and a layer of incompressible isotropic elastic solid was studied. Two distinct modes of instability were found. The interfacial mode occurred at small Reynolds number when the solid was soft. For this mode, the rigidity of the solid was a stabilizing factor, whereas the viscosity of the fluid was destabilizing. There was a critical elastic parameter, beyond which the flow became unstable regardless of the viscosity of the fluid. The shear wave mode occurred at large Reynolds number. The stability of plane Couette flow of an incompressible viscous fluid between a moving plate and a layer of incompressible isotropic elastic solid was also investigated. It was found that the instability of interfacial mode was essentially similar to that of plane Poiseuille flow. It required, however, softer solid or higher critical speed to induce the instability than does the plane Poiseuille flow. Dissert. Abstr.

N78-32367 Virginia Polytechnic Inst. and State Univ., Blacksburg.
TWO AND THREE-DIMENSIONAL INCOMPRESSIBLE AND COMPRESSIBLE VISCOUS FLUCTUATIONS Ph.D. Thesis
Tej R. Gupta 1977 154 p
Avail: Univ. Microfilms Order No. 78-14034

Special classes of unsteady two and three dimensional incompressible and compressible boundary-layer flows are presented. The general character of the mathematical problem was first investigated for each particular area. Asymptotic solutions were then provided based on the assumption of small amplitude and small frequency of oscillation. Systems of general differential equations in a single variable were obtained and solved numerically by the shooting technique. A straight forward fourth order Runge-Kutta integration scheme was employed and the values of the functions at the edge of the boundary layer were checked against the outer flow boundary conditions. Dissert. Abstr.

N78-32368 Maryland Univ., College Park.
DIFFICULTIES IN THE KINETIC THEORY OF TRANSPORT PROCESSES IN GASES IN THREE DIMENSIONS Ph.D. Thesis
Jagdish Chandra Sharma 1977 154 p
Avail: Univ. Microfilms Order No. 7812892

A renormalized nonlinear kinetic equation is derived for a gas of hard spheres that incorporates the contributions from binary collisions as well as from an important class of collision events, the ring events. Using this equation, the hydrodynamic equations and the associated transport coefficients are obtained. Expressions for the Navier-Stokes and the Burnett transport coefficients are obtained. The contributions of the slowly decaying hydrodynamic modes of the 'ring sum operator' to the linear and nonlinear Burnett transport coefficients were calculated. The

kinetic equation method to obtain transport coefficients is compared with the time correlation function method.
Dissert. Abstr.

N78-32369 Missouri Univ. - Columbia.
PRESSURE DROP MEASUREMENTS AND FLOW VISUALIZATION OVER ROUGHNESS ELEMENTS Ph.D. Thesis
Dale Edward Klein 1977 206 p
Avail: Univ. Microfilms Order No. 7814126

The flow properties surrounding the roughness element were characterized and quantified. Several roughness shapes were examined in a recirculating wind tunnel arrangement by developing a flow visualization technique that allowed both qualitative (flow direction) and quantitative (flow velocity) information to be obtained. This technique consisted of injecting micron size solid flow tracing particles and recording their trace photographically. In addition, pressure drop measurements were obtained. The flow visualization and pressure drop measurements revealed several important factors which resulted in a recommended change in the present design shape for the gas cooled fast breeder reactor fuel rod roughness elements. Dissert. Abstr.

N78-32370 State Univ. of New York at Stony Brook.
DEVELOPMENT OF LASER DOPPLER ANEMOMETER TECHNIQUE FOR THE MEASUREMENT OF TWO-PHASE DISPERSED FLOW Ph.D. Thesis
Jagannathan Srinivasan 1978 193 p
Avail: Univ. Microfilms Order No. 78-13919

An optical technique using Laser-Doppler Anemometry is presented for the measurement of the local number densities and two-dimensional velocity probability densities of a turbulent dilute two-phase dispersion which has a distribution of particle size and a predominate direction of flow. The developed Laser-Doppler Anemometer (LDA) technique was applied to a solid particle-water two-phase flow and a water droplet-air two-phase flow. Particular emphasis was placed on turbulent two-phase water droplet-air flow inside a vertical rectangular channel. The particle size and number density distributions, and the axial and lateral velocity distributions of both phases are reported. A discussion of the relationship between the particle distributions and turbulent flow characteristics is presented.
Dissert. Abstr.

N78-32371 Michigan Univ., Ann Arbor.
HEAT TRANSFER AUGMENTATION IN FLOWS OVER AND NORMAL TO HIGH-POROSITY PERFORATED SURFACES Ph.D. Thesis
Ching-Pang Lee 1978 193 p
Avail: Univ. Microfilms Order No. 7813691

Heat transfer and friction loss performances for flows over and normal to stacks of perforated plates were experimentally studied by means of a single blow transient test technique in a subsonic wind tunnel. The hole diameter, pitch, plate spacing and flow velocity were varied. Dissert. Abstr.

N78-32372 California Univ., Berkeley.
AN EXPERIMENTAL AND THEORETICAL STUDY OF UNSTEADY HEAT TRANSFER DURING PISTON COMPRESSION Ph.D. Thesis
Manuchehr Nikanjam 1977 104 p
Avail: Univ. Microfilms Order No. 78-12713

The unsteady heat transfer from a gas to a surface during piston compression was discussed. To determine the wall heat flux a thin film resistance thermometer was used. Another determination of the heat flux was obtained from the solution of the conservation equations in the gas boundary layer near the wall. This analysis used the isentropic compression relation for the bulk gas outside the boundary layer. The results for the heat flux obtained from these two independent methods, one based on the solid, the other on the gas, were in good agreement. This agreement was obtained for measurements in air and in argon, and for gauges that were placed at either the end wall or the side wall. Results were also obtained for the heat transfer coefficient and a non-monatonic variation with respect to time was observed and discussed. Dissert. Abstr.

N78-32373 Michigan Univ., Ann Arbor.
NONEQUILIBRIUM BLOWDOWN IN LONG PIPES Ph.D. Thesis
William Stanley Winters, Jr. 1978 282 p
Avail: Univ. Microfilms Order No. 7813760

The blowdown was studied of an initially static compressed liquid from a long horizontal tube closed at one end and fitted with a membrane at the other. Blowdown (rapid liquid-to-vapor phase transition) was initiated by piercing the membrane and exposing the pipe contents to a pressure substantially below the saturation pressure corresponding to the initial liquid temperature. A phase equilibrium pipe blowdown model is formulated from the one-dimensional-transient conservation equations and a stable and covergent finite difference algorithm is proposed for the explicit solution of the conservation equations in the Eulerian frame of reference. The present algorithm is successful in eliminating serious calculational inaccuracies which were found to occur in compressible flows with steep spatial property gradients. A method was also devised for solving the conservation equations from the Lagrangian point of view making it possible to trace the history of the fluid as it passes through the pipe. Dissert. Abstr.

N78-32374 Washington State Univ., Pullman.
TURBULENT HYDRAULIC PENETRATION FROM TURBULENT PIPE FLOW INTO STAGNANT COLUMNS Ph.D. Thesis
Gerald Robert Bloom 1978 111 p
Avail: Univ. Microfilms Order No. 7811884

An experimental investigation was conducted on the depth of mixing of water from turbulent pipe flow into a vertically oriented pipe deadleg or stagnant column. The depth of turbulent penetration or mixing length (ML) was correlated as a function of the piping system Reynolds number (Re) and kinematic viscosity. The dimensionless mixing length (ML) is defined as the depth of hydraulic mixing divided by the inside diameter of the dead-leg. Water was pumped at flow rates between 40 l/min and 750 l/min through smooth tubing sections with inside diameters between 22 mm and 73 mm. Isothermal experimental runs were performed at water temperatures between 30 C and 80 C. Dissert. Abstr.

N78-32375 Purdue Univ., Lafayette, Ind.
TURBULENT CHARACTERISTICS OF LABORATORY GENERATED OVERLAND FLOW: A STATISTICAL ANALYSIS Ph.D. Thesis
Hagop Leon Shahabian 1977 230 p
Avail: Univ. Microfilms Order No. 7813119

A rainfall generator superimposed different rainfall rates on a base sheet flow to simulate the overland flow. A split hot film sensor was used to measure the mean and fluctuating components of the longitudinal and vertical velocities and Reynolds stresses throughout the flow field with or without rainfall. A shear stress sensor, used in conjunction, measured the instantaneous stress. A conditional sampling technique of the Reynolds stress and velocity fluctuations was used to study the effect of the rainfall on the bursting process inherent to shear flows. In this respect the joint probability distributions of the velocity components are also presented. The advent of the rainfall destroys the bursting sequence and shifts the emphasis from the ejection and sweep sequences to the interaction sequences. This results, in some cases, in reversals of the turbulent shear stress directions. Dissert. Abstr.

N78-32376 Pennsylvania State Univ., University Park.
MIXING AND SEGREGATION IN FLOWING POWDERS Ph.D. Thesis
Cheng-Liang Hwang 1978 207 p
Avail: Univ. Microfilms Order No. 7812053

The mechanisms of mixing and segregation of particulate materials flowing over inclined surfaces and in horizontal rotating cylinders was examined and analyzed. Three physical models are proposed to describe the mixing phenomena within the powder stream. One of these proposed models, in which it is assumed that mixing occurs through a diffusion mechanism and that the diffusion coefficient varies linearly with the velocity gradient in the flowing stream, was shown to give excellent agreement with experimental data. This model is further employed to predict the pure mixing phenomena at different chute lengths and with different initial loading conditions. Excellent agreement between

theory and experiment indicates that the model gives a good description of the mixing process. Dissert. Abstr.

N78-32377 Johns Hopkins Univ., Baltimore, Md.
LINEAR AND NON-LINEAR RESPONSE OF VISCOELASTIC FLUIDS Ph.D. Thesis
Robert Louis Powell 1978 255 p
Avail: Univ. Microfilms Order No. 7811790

The methods of continuum mechanics are used to obtain approximate constitutive relations for simple flows of viscoelastic fluids. Measurements were made using polymeric materials to verify some solutions of the derived equations. An infinitesimal disturbance superimposed on a basic state flow consisting of either a steady shearing or extension is shown to cause stresses that are linear functionals of this disturbance. In this theory, three functions characterize the disturbance stresses for steady extensions. The dynamics of small oscillatory displacements about an extensional flow are examined. Both a linear and a non-linear theory of non-Newtonian materials are used to solve problems in which disturbances are in the same direction as the steady shearing motion. These solutions relate measurable quantities to material properties and were the basis for two experiments. Dissert. Abstr.

N78-32378 Purdue Univ., Lafayette, Ind.
HEAT EXCHANGER NETWORK SYNTHESIS: A THERMODYNAMIC APPROACH Ph.D. Thesis
S. Raghavan 1977 126 p
Avail: Univ. Microfilms Order No. 78-13106

In chemical process industries, some process streams have to be heated, while others have excess heat energy available. Proper matching of these streams to recover energy most economically is the problem of heat exchanger network synthesis. A study of the problem reveals that it is combinatorial, and that heat transfer feasibility is dynamic. A logical selection procedure is given for the combinatorial synthesis problem. Dissert. Abstr.

N78-32379 Minnesota Univ., Minneapolis.
PARTICLE MOTION IN A TURBULENT FLUID Ph.D. Thesis
Jeffrey Howard Schott 1978 140 p
Avail: Univ. Microfilms Order No. 7813452

A new type of apparatus was developed for use in the study of particle motion in turbulent fluids which permits observation of particle movement unencumbered by average fluid motion. Measurement of deflection permitted the force on each rake to be calculated, from which the rate at which energy was dissipated by the fluid was computed. This device was used to investigate motion of particles, whose size was between the turbulent micro-scale and integral scale, in a turbulent fluid. Particle motion was compared with fluid motion using a streak photograph technique to determine how well particles could follow fluid motion. It was concluded that particle motion, driven by fluid motion, had dependent diffusivity but independent direction. Dissert. Abstr.

N78-32380 Purdue Univ., Lafayette, Ind.
DYNAMIC RESPONSE MODEL FOR CROSS-FLOW HEAT EXCHANGERS Ph.D. Thesis
Jay Lloyd Boot 1977 156 p
Avail: Univ. Microfilms Order No. 7813030

A model was developed to predict the dominant first order response of the outlet-air temperature to a change in water flow rate for single row serpentine, single row headered, multirow parallel, and multirow counter crossflow heat exchangers. In order to characterize these heat exchangers (coils), expressions for the gain, and the time constant, were determined. These simplified expressions are based upon coil geometry and standard heat transfer correlations so that the model is in a form useful to system designers in selecting controls and sensing elements in heat exchanger control applications. Experimental verification of the model for a single row serpentine coil, a multirow parallel, and a counter crossflow coil with turbulent water flow as well as a single row headered coil with laminar, transitional, and turbulent water flow was obtained. Two limiting cases were successfully analyzed. Dissert. Abstr.

N78-32381 Michigan Univ., Ann Arbor.
LAMINAR TRANSPORT PHENOMENA IN PARALLEL DUCTS WITH ABRUPT CONTRACTION AND EXPANSION Ph.D. Thesis
Sahas Bunditkul 1978 182 p
Avail: Univ. Microfilms Order No. 78-13622

A flow system consisting of a parallel duct, or rectangular duct with an aspect ratio of infinity, with flow at the entrance section of the duct is laminar, fully developed. The full Navier-Stokes equations and energy equations are solved numerically using a finite-difference technique. The results are obtained for Reynolds numbers up to 2000. The results for Fanning friction factor, f, contraction coefficient K sub c and expansion coefficient, K sub e at different delta and Re are obtained. A hydrodynamic entry length and a combined hydrodynamic entry length are also obtained. Two cases of heat transfer at the constriction surface, constant surface temperature and constant surface heat flux, are solved. Dissert. Abstr.

N78-32382 Washington Univ., Seattle.
MEASUREMENT OF FLUID TURBULENCE BASED ON PULSED ULTRASOUND TECHNIQUES Ph.D. Thesis
Joseph Lawrence Garbini 1977 220 p
Avail: Univ. Microfilms Order No. 7814433

A three-dimensional stochastic model of the pulsed ultrasonic Doppler velocimeter for the case of a highly focused and damped transducer for isotropic turbulence is presented. The analysis predicts the correlation and spectral functions of the Doppler signal and the detected velocity signal. The same time approximation is made for the statistics of the Langrangian particle motion. Explicit results are given for the case in which the sample volume directivity is assumed to be a three-dimensional Gaussian function. The analysis specifically addresses the considerations and limitations of measuring turbulent intensities and one-dimensional velocity spectra. An extensive experimental program in both laminar and turbulent flow was undertaken to examine the validity of all major model implications. Dissert. Abstr.

N78-32383 Rice Univ., Houston, Tex.
CAVITATION INCEPTION ON DECELERATING SURFACES Ph.D. Thesis
Toshimasa Tokuno 1978 108 p
Avail: Univ. Microfilms Order No. 7814810

A piston and cylinder system was used to study incipient cavitation. In the system, a moving piston was driven by a spring and stopped suddenly. While the piston is stopping (decelerating), the inertia of the liquid in motion tends to separate the liquid from the piston face, resulting in a pressure reduction in the cylinder. If the pressure reduction is large enough, cavitation is created on the piston face, where the lowest pressure is achieved. By measuring the acceleration of the piston and the pressure downstream in the cylinder and also by taking high speed motion pictures, a critical point of cavitation inception was defined. Examining various parameters, it was found that the shape of the pressure reduction history, system temperature, and piston material are the important parameters for the critical point, while system pressure surface tension, and viscosity have relatively little effects. Dissert. Abstr.

N78-32384*# National Aeronautics and Space Administration, Washington, D. C.
DYNAMIC STALL: AN EXAMPLE OF STRONG INTERACTION BETWEEN VISCOUS AND INVISCID FLOWS
Jean-Jacques Philippe Sep. 1978 57 p refs Transl. into ENGLISH of "Le Dechrochage Dynamique, un Exemple d'Interaction Forte entre Ecoulements Visqeux et Non-visqueux", Rept. ONERA-TP-1977-135 Onera, Paris, 1977 22 p Presented at the Symp. on Unsteady Aerodyn., Ottawa, 26-28 Sep. 1977; sponsored by NATO and AGARD Original language document was announced as A78-24467 Transl. by SCITRAN, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75447; ONERA-TP-1977-135) Avail: NTIS HC A04/MF A01 CSCL 20D

A study was done of the phenomena concerning profiles in dynamic stall configuration, and more specially those related to pitch oscillations. The most characteristic experimental results on flow separations with a vortex character, and their repercussions

on local pressures and total forces were analyzed. Some aspects of the methods for predicting flows with the presence (or not) of boundary layer separation are examined, as well as the main simplified methods available to date for the calculation of total forces in such configurations. L.S.

N78-32385*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
INVERSE BOUNDARY-LAYER THEORY AND COMPARISON WITH EXPERIMENT
James E. Carter Sep. 1978 55 p refs
(NASA-TP-1208; L-12190) Avail: NTIS HC A04/MF A01 CSCL 20D

Inverse boundary layer computational procedures, which permit nonsingular solutions at separation and reattachment, are presented. In the first technique, which is for incompressible flow, the displacement thickness is prescribed; in the second technique, for compressible flow, a perturbation mass flow is the prescribed condition. The pressure is deduced implicitly along with the solution in each of these techniques. Laminar and turbulent computations, which are typical of separated flow, are presented and comparisons are made with experimental data. In both inverse procedures, finite difference techniques are used along with Newton iteration. The resulting procedure is no more complicated than conventional boundary layer computations. These separated boundary layer techniques appear to be well suited for complete viscous-inviscid interaction computations.
Author

N78-32386*# Tennessee Univ., Tullahoma.
STUDIES OF CONVECTION IN A SOLIDIFYING SYSTEM WITH SURFACE TENSION AT REDUCED GRAVITY
Basil N. Antar and Frank G. Collins Sep. 1978 69 p refs
(Contract NAS8-32484)
(NASA-CR-3051; M-265) Avail: NTIS HC A04/MF A01 CSCL 20D

The low gravity environment of Earth's orbit is being seriously considered for experimentation on the production of materials in space. Most of such materials processes inevitably involve either the solidification of melt or the melting of solids. Inherent in most fluid mechanisms with temperature gradients is convective motion. A study is presented for the onset of convection in a solidifying system in an environment which is similar to that encountered in space processing. Since the study is for a low gravity condition, the only driving mechanism considered is that due to the variation of surface tension force at the free surface of the melt layer. Two simple solidification models were considered, one in which the solidification process enters in the perturbation system and another in which the melt is solidifying at a constant rate. The results show that the solidification process will bring about convection in the melt earlier than otherwise.
B.B.

N78-32387*# California State Univ., Los Angeles. Dept. of Mechanical Engineering.
DEVELOPMENT OF A DIRECT CONTACT HEAT EXCHANGER, PHASE 1 STUDY REPORT
Ram Manvi 30 Sep. 1978 75 p refs
(Grant NsG-7229)
(NASA-CR-157737; ME-78-NSG-7229) Avail: NTIS HC A04/MF A01 CSCL 20D

Electric power generation from geothermal brine requires, first, bringing the hot brine to the surface and then converting the heat to electric power. Binary conversion schemes were proposed, with the heat transfer between the brine and the working organic fluid taking place in a conventional tube and shell heat exchanger. If the brine is heavily laden with dissolved solids, however, solids buildup on the heat exchanger surfaces leads to a considerable degree of fouling and an accompanying drop in performance is experienced. A possible solution to this problem is the use of a direct contact exchanger with the secondary fluid power cycle. The proposed concept involves the formation of fluid sheets and bells as heat angles. Results of a study concerning the fluid mechanics of such surfaces are given. G.G.

N78-32388# Dayton Univ. Research Inst., Ohio.
STUDIES OF HYDRODYNAMIC RAM INDUCED BY HIGH VELOCITY SPHERICAL FRAGMENT SIMULATORS Final Report, Aug. 1975 - Nov. 1976
S. J. Bless, P. F. Fry, J. P. Barber, and R. K. Newman Jun. 1977 173 p refs
(Contract F33615-75-C-5156)
(AD-A055003; UDRI-TR-77-09; AFML-TR-77-11) Avail: NTIS HC A08/MF A01 CSCL 19/4

Hydrodynamic ram events in simulated fuel cells have been studied both experimentally and theoretically. A moire fringe technique was developed for dynamic measurement of out-of-plane displacement. Spherical projectiles 11.1 and 14.3 mm diameter were used in the velocity range 1.5 to 2.4 km/s. Data for entrance and side panel displacement, projectile trajectory, cavity growth, shock propagation, and fluid pressure were obtained for many impact configurations. A fluid drag code, a fluid shock code, the BR-1A (HR) code, the AFTON finite difference code, and the NONSAP finite element code were exercised and the results compared with experimental data. It was found that the failure mode of entrance panels was propagation of cracks caused by hoop stresses induced at very early times around the entrance site. Entrance panel damage was reduced by use of ductile alloys and eliminated by ballistic foam of thickness equal to the projectile diameter. GRA

N78-32389# Dayton Univ. Research Inst., Ohio.
SIMULATION OF FRICTION, WEAR, AND GOUGING FOR A HYPERVELOCITY GUIDE-RAIL SYSTEM Final Report, 15 Jun. 1975 - 23 Sep. 1977
Louis I. Boehman, John P. Barber, and Hallock F. Swift May 1978 168 p refs
(Contract F40600-75-C-0008)
(AD-A054997; UDRI-TR-77-68; AEDC-TR-78-19) Avail: NTIS HC A08/MF A01 CSCL 20/4

A computer model was developed to describe friction, wear, and gouging that may occur at the projectile-rail interface of a hypervelocity projectile being guided by alignment rails. Study of the gasdynamics of the interface region reveals that three types of flow can occur depending upon the associated Reynolds number computed with respect to projectile/rail separation, Re sub h. The flow conditions are laminar Couette flow Re (sub h - 1,000); turbulent Couette flow (1,000 - Re sub H - 100,000); turbulent boundary flow (Re sub h = 100,000). Pressures developed within the gap affect the projectile dynamics significantly and, in turn, are affected by projectile motions and orientations produced by external gasdynamics interactions. In general, the interface pressures act to promote dynamic stability of projectiles in flight. Accordingly, a complete treatment of interface regions required development of a Projectile Dynamics Computer Program which describes the complete process of rigid projectiles passing along rail guidance systems. GRA

N78-32390# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
THE SMALL SIGNAL RESPONSE OF FLUID TRANSMISSION LINES, INCLUDING DEVELOPED MEAN FLOW EFFECTS Ph.D. Thesis Final Technical Report, 3 Jan. 1973 - 16 Dec. 1977
Ernest F. Moore Mar. 1978 187 p refs
(AF Proj. 2403)
(AD-A055854; AFFDL-TR-78-12) Avail: NTIS HC A09/MF A01 CSCL 17/2

Mathematical models of fluid transmission lines of arbitrary cross section were developed to describe the propagation of small signals through developed mean flow. The mean flow may be either laminar or turbulent and the fluid, either compressible or incompressible. Expressions for both the frequency and time domain dynamic responses are derived. A characteristic radius is defined for any line of arbitrary cross section, which essentially defines an equivalent circular line having the same dynamic response. The characteristic radius used in dynamic analysis is roughly analogous to the hydraulic radius used in steady flow analysis. In developing the models, the frequency response of annular transmission lines was solved and compared to existing solutions for circular and rectangular lines. Next, the frequency and time domain solutions applicable to arbitrary lines carrying laminar mean flow were obtained in terms of equivalent circular lines. Finally, the concept of a characteristic radius was extended to arbitrary fluid lines carrying turbulent mean flow. The results are shown to be relatively very easy to apply, yet comparable

in accuracy to existing, very complex models. The new models should be of significant value to the practicing engineer in fluid systems design and analysis. Author (GRA)

N78-32391# General Electric Co., Schenectady, N. Y.
UNSTEADY BLADE ROWS IN HIGH-SPEED FLOW Final Report, 1 Jan. 1974 - 31 Dec. 1977
M. Kurosaka May 1978 167 p refs
(Contract F44620-74-C-0040)
(AD-A055620; SRD-78-063; AFOSR-78-1055TR) Avail: NTIS HC A08/MF A01 CSCL 20/4

This report covers analytic investigations toward defining the instability boundaries of low incidence supersonic compressor flutter. A closed form expression was developed for the unsteady pressure distribution for a flat plate cascade in supersonic flow which is valid for a frequency range of practical interest. The work was extended to symmetric parabolic arc airfoils in cascade. Finite thickness was shown to have a first order effect on the flow field. Coupling the flow analysis with blade vibration modes indicates a bending instability in the frequency range of conventional design in general agreement with experimental data. An expression for the frequency of the unsteady pressure along the stationary rotor casing due to a vibrating blade row was derived. It indicates casing treatment tuned approximately to blade passing frequency and its harmonics should be effective in absorbing this unsteady flow energy. GRA

N78-32392# Texas A&M Research Foundation, College Station.
AEROELASTIC CHARACTERISTICS OF A CASCADE OF BLADES Final Report, 1 Apr. 1974 - 31 Dec. 1977
Balusu M. Rao and Louis Kronenberger, Jr. Feb. 1978 32 p refs
(Grant AF-AFOSR-2700-74; AF Proj. 2307)
(AD-A055619; AFOSR-78-1027TR) Avail: NTIS HC A03/MF A01 CSCL 20/4

A general aerodynamic theory and a numerical lifting surface technique based on velocity potential formulation for predicting aerodynamic derivatives of a cascade of blades in subsonic flow is described. The unsteady airload prediction method is applied for predicting the flutter boundaries of a single degree-of-freedom in torsion of a cascade of blades. Also, a general flutter program is developed for a two degree-of-freedom staggered cascade in subsonic flow. By utilizing an iterative procedure which permits frequency variation. The flutter frequency and the flutter speed of the reference airfoil are obtained as a function of cascade parameters. The computer program uses very efficient techniques in computing unsteady loads, the flutter frequency, and the flutter speeds. Author (GRA)

N78-32393# Los Alamos Scientific Lab., N. Mex.
FINITE-DIFFERENCE METHODS IN MULTI-DIMENSIONAL TWO-PHASE FLOW
J. R. Travis 1977 19 p refs Presented at 3d Intern. Symp. on Computing Methods in Applied Sci. and Eng., Versailles, France, 2 Dec. 1977
(Contract W-7405-eng-36)
(LA-UR-77-2378; Conf-771204-1) Avail: NTIS HC A02/MF A01

The Theoretical Division of the Los Alamos Scientific Laboratory began several research programs in the area of reactor safety for the United States Nuclear Regulatory Commission. Research efforts were started in the Liquid Metal Fast Breeder (LMFBR) and the Light Water Reactor (LWR) safety programs. The character of the Theoretical Division was to develop computer codes for the safety analysis of these reactor systems. The question of whether or not, during the course of a hypothetical accident sequence in an LMFBR, the core will subside to a coolable configuration without secondary critical bursts has never been resolved. To aid the study of this question, a computer program called SIMMER (S/sub/N/, Implicit, Multified, Multicomponent, Eulerian Recriticality) was developed to predict the dynamics of extreme hypothetical accident sequences during which extended core motion is expected. ERA

N78-32394# West Virginia Univ., Morgantown. Dept. of Mechanical Engineering and Mechanics.
FURTHER STUDIES OF PULSATILE FLOW THROUGH AN ORIFICE Interim Report
K. R. Ferguson and R. A. Bajura Jan. 1978 227 p refs
(Grant NSF ENG-74-10399-C)
(PB-280762/6; NSF/ENG-74-10399-C) Avail: NTIS HC A11/MF A01 CSCL 20D

The metering error for orifices under pulsatile flow conditions is considered for air and water as working fluids. Velocity measurements were obtained using hot film and laser anemometry techniques. Differential pressures were measured using damped manometers, differential pressure meter, and strain gage pressure transducers. Crystal transducers were used to measure the rms differential pressure fluctuations. The observed metering errors were both positive and negative, depending upon the orifice used and the pressure measurement system. The pulsatile flow velocity profiles developed faster than the steady flow case in the downstream region. GRA

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N78-32395* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ANGLE DETECTOR Patent
Gilbert T. Parra, inventor (to NASA) Issued 13 Jun. 1978 8 p Filed 10 Nov. 1976 Supersedes N77-11364 (15 - 02, p 0194)
(NASA-Case-ARC-11036-1; US-Patent-4,094,073; US-Patent-Appl-SN-740457; US-Patent-Class-33-366) Avail: US Patent Office CSCL 14B

An angle detector for determining a transducer's angular disposition to a capacitive pickup element is described. The transducer comprises a pendulum mounted inductive element moving past the capacitive pickup element. The capacitive pickup element divides the inductive element into two parts L sub 1 and L sub 2 which form the arms of one side of an a-c bridge. Two networks R sub 1 and R sub 2 having a plurality of binary weighted resistors and an equal number of digitally controlled switches for removing resistors from the networks form the arms of the other side of the a-c bridge. A binary counter, controlled by a phase detector, balances the bridge by adjusting the resistance of R sub 1 and R sub 2. The binary output of the counter is representative of the angle.
Official Gazette of the U.S. Patent Office

N78-32396* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
VELOCITY MEASUREMENT SYSTEM Patent
Walter Haeussermann, inventor (to NASA) Issued 6 Jun. 1978 7 p Filed 6 Oct. 1976 Supersedes N76-33469 (14 - 24, p 3133)
(NASA-Case-MFS-23363-1; US-Patent-4,093,917; US-Patent-Appl-SN-730046; US-Patent-Class-324-173; US-Patent-Class-324-207) Avail: US Patent Office CSCL 14B

A velocity sensor is described for sensing the speed of a moving conductive body, employing an E-shaped magnetic core, having a pair of spaced Hall effect devices positioned on the end of the central core. The ends of all cores were arranged adjacent to the path of the moving conductive body. The difference in output voltage registered by the two Hall effect devices was indicative of the speed of the conductive body.
Official Gazette of the U.S. Patent Office

N78-32397* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
MAGNETOMETER WITH A MINIATURE TRANSDUCER AND AUTOMATIC SCANNING Patent
William J. Jr. Debnam, Carl L. Fales, Jr., Roger A. Breckenridge, and Arthur V. Pohm, inventors (to NASA) (Iowa State Univ. of

Sci. and Technol.) Issued 9 May 1978 5 p Filed 19 Mar. 1976 Supersedes N77-17430 (15 - 08, p 1035) Continuation of abandoned US Patent Appl. SN-547072, filed 4 Feb. 1975
(NASA-Case-LAR-11617-2; US-Patent-4,088,954; US-Patent-Appl-SN-668771; US-Patent-Class-324-249; US-Patent-Appl-SN-547072) Avail: US Patent Office CSCL 14B

The magnetometer is based on the time variation of the magnetic permeability in the magnetic material of its transducer; however, its operation is substantially different from the ordinary flux-gate magnetometer. The transducer uses 0.05 mm diameter plated magnetic wire and is made flat enabling it to make measurements of transverse magnetic fields as close as 0.08 mm from the surface, and it has very good spatial resolution because of its small active region of approximately 0.64 mm by 0.76 mm. The magnetometer uses an inexpensive clip-on millimeter for driving and processing the electrical signals and readout. It also utilizes an automatic scanning technique which is made possible by a specially designed transducer holding mechanism that replaces the ink pen on an X-Y recorder.
Official Gazette of the U.S. Patent Office

N78-32398*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
VISIBLE AND INFRARED POLARIZATION RATIO SPECTRO-REFLECTOMETER Patent Application
Carmen E. Batten, inventor (to NASA) Filed 28 Jul. 1978 19 p
(NASA-Case-LAR-12285-1; US-Patent-Appl-SN-929087) Avail: NTIS HC A02/MF A01 CSCL 14B

The invention relates to an instrument for determining the optical constants of a sample material by causing light of various angles of polarization to impinge upon the sample at various angles of incidence and measuring the intensity of the reflected light at various wavelength. The ratio of the intensity of the reflected light for parallel polarized light to that for perpendicular polarized light at two different angles of incidence can be used to determine the optical constants of the sample. The novel feature of the invention appears to reside in a spectroreflectometer employing coordinated rotating platforms which enable the automatic alignment of the instrument at a wide variety of angles of incidence. NASA

N78-32399*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DUAL ACTING SLIT CONTROL MECHANISM Patent Application
Gustav L. Struthoff, inventor (to NASA) (Rensselaer Polytechnic Inst., Troy, N. Y.) Filed 8 Sep. 1978 13 p Sponsored by NASA
(NASA-Case-LAR-11370-1; US-Patent-Appl-SN-940689) Avail: NTIS HC A02/MF A01 CSCL 14B

The invention relates to an apparatus for the adjustment of the collimating slit width and centering of the collimating slit of a mass spectrometer while using only one vacuum penetration. Coaxial shafts, each with independent vacuum bellows are used to independently move the entire collimating assembly and to adjust the slit dimension through a parallelogram linkage. The novelty of the invention is in securing two independent control functions through a single penetration in a vacuum barrier with a simple and inexpensive mechanism. NASA

N78-32400# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.
INFRARED MOTION SENSOR EVALUATION
William C. Garrett Mar. 1978 151 p
(AD-A055202; MERADCOM-2237) Avail: NTIS HC A08/MF A01 CSCL 17/5

This report describes the test program performed by MERADCOM to determine the performance and reliability of model 19-115 Infrared Intrusion Sensor (IRIS). Three commercial infrared sensors were included in the test program to establish a base for comparing the test data. Each sensor was subjected to detection, nuisance alarms, electromagnetic interference (EMI), and temperature to determine each sensor's operating effectiveness when exposed to these conditions. The report describes each test performed and gives detailed performance data for each sensor. Author (GRA)

N78-32401# California Univ., Livermore. Lawrence Livermore Lab.
NICKEL-CHROMIUM STRAIN GAGES FOR CRYOGENIC STRESS ANALYSIS OF SUPERCONDUCTING STRUCTURES IN HIGH MAGNETIC FIELDS
H. S. Freynik, Jr., D. R. Roach, D. W. Deis, and D. G. Hirzel 5 Oct. 1977 7 p refs Presented at 7th Symp. on Fusion Res. Project, Knoxville, Tenn., 25 Oct. 1977
(Contract W-7405-eng-48)
(UCRL-79726; Conf-771029-101) Avail: NTIS HC A02/MF A01

Evaluation and calibration measurements were performed on commercial nickel-chromium metal-foil strain gages in a high-magnetic field, liquid-helium environment. The magnetoresistance of a number of strain gages was measured in three orthogonal directions at mechanical strain levels to 8900 microns. As a result, a unique calibration curve was defined for magnetoresistance strain errors that is independent of strain level and field direction to 12 T at 4.2 K. A current strain gage application is the measurement of superconductor mechanical properties. ERA

N78-32402# National Technical Information Service, Springfield, Va.
APPLICATIONS OF HOLOGRAPHY, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Final Report, 1975 - Jun. 1978
Edward J. Lehmann Jun. 1978 285 p Supersedes NTIS/PS-77/0508; NTIS/PS-76/0452; NTIS/PS-75/431; COM-74-11958 (NTIS/PS-78/0561/7; NTIS/PS-77/0508; NTIS/PS-76/0452; NTIS/PS-75/431; COM-74-11958) Avail: NTIS HC $28.00/MF $28.00 CSCL 14B

The bibliography covers studies on the applications of holography in such areas as photographing high-speed particles, nondestructive testing of material defects, strain analysis, microscopy, interferometry, vibration measurement, and medical diagnosis. GRA

N78-33027# Joint Publications Research Service, Arlington, Va.
SCIENTIFIC INSTRUMENT MAKING PRODUCT IDENTIFICATION APPROACH DISCUSSED
A. P. Pakhomov *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., no. 44 (JPRS-71659) 10 Aug. 1978 p 46-49 refs Transl. into ENGLISH from Prib. Sist. Upr. (Moscow), no. 5, 1978 p 46 (For primary document see N78-33024 23-99)
Copyright. Avail: NTIS HC A05/MF A01

36 LASERS AND MASERS

Includes parametric amplifiers.

N78-32403 Pennsylvania State Univ., University Park.
LASER LIGHT SCATTERING OF GLASS AS RELATED TO MELTING HISTORY Ph.D. Thesis
Walter Francis Olix 1978 163 p
Avail: Univ. Microfilms Order No. 7812069

Microstructural changes occurring as a function of melting time and melting atmosphere were studied by laser light scattering. A laser light scattering apparatus was developed which allowed microstructural information to be obtained for inhomogeneities in size ranges and of compositional differences where other analytical tools yielded no information. In addition, the laser light scattering technique, in conjunction with the apparatus, permitted use of easily prepared glass samples. Atmospheres of dry oxygen or vacuum over the melt were found to have a significant effect on the microstructure of glasses calculations show that vacuum melting increases the size of the microphases, decreases the concentration and interfacial area while increasing the light scattering intensities. Dissert. Abstr.

N78-32404 State Univ. of New York at Buffalo.
LASER INDUCED MOTION OF ELASTIC SOLIDS Ph.D. Thesis
Thangavel Paramasivam 1978 99 p
Avail: Univ. Microfilms Order No. 7817070

The motion of a rectangular plate subjected to laser irradiation

was considered. A solution is presented within the framework of classical thermoelasticity theory. The plate was assumed to be simply supported and irradiated by a laser beam with axis normal and central to the plate surface. The solution is presented in two parts: local thickness stretch motion, and motion of the entire plate. Dissert. Abstr.

N78-32405*# RCA Labs., Princeton, N. J.
THE 1.1 MICROMETER AND VISIBLE EMISSION SEMICONDUCTOR DIODE LASERS Final Report, 1 Jan. - 30 Nov. 1977
I. Ladany, C. J. Nuese, and H. Kressel Oct. 1978 124 p refs
(Contract NAS1-14349)
(NASA-CR-3045; PRRL-77-CR-52) Avail: NTIS HC A06/MF A01 CSCL 20E

In (AlGa)As, the first of three alloy systems studied, Continuous Wave (CW) operation was obtained at room temperature at a wavelength as low as 7260 A. Reliability in this system was studied in the incoherent mode. Zinc doped devices had significant degradation, whereas Ge or Ge plus Zi doped devices had none. The Al2O3 facet coatings were shown to significantly reduce facet deterioration in all types of lasers, longer wavelength units of that type having accumulated (at the time of writing) 22,000 hours with little if any degradation. A CL study of thin (AlGa)As layers revealed micro fluctuation in composition. A macro-scale fluctuation was observed by electroreflectance. An experimental and theoretical study of the effect of stripe width on the threshold current was carried out. Emission below 7000 A was obtained in VPE grown Ga(AsP) (In,Ga)P with CW operation at 10 C. Lasers and LED's were made by LPE in (InGa) (AsP). Laser thresholds of 5 kA/cm2 were obtained, while LED efficiences were on the order of 2%. Incoherent life test over 6000 hours showed no degradation.
J.M.S.

N78-32406# Nagoya Univ. (Japan). Inst. of Plasma Physics.
POSSIBILITY OF STABLE IMPLOSION OF STRUCTURED PELLET, 2
T. Yabe and K. Niu Jun. 1978 22 p refs
(IPPJ-342) Avail: NTIS HC A02/MF A01

A model of implosion is proposed and the possibility of stable implosion is discussed on the basis of this model. The model indicates a relaxation of the restrictions on the peak power and the culmination time of laser light required for pellet implosion. G.Y.

N78-32407# United Technologies Research Center, East Hartford, Conn.
INVESTIGATION OF PLASMA PROCESSES IN ELECTRONIC TRANSITION LASERS Technical Report, 1 Jul. 1977 - 1 Jul. 1978
William L. Nighan 1 Jul. 1978 84 p refs
(Contract N00014-76-C-0847)
(AD-A055792; UTRC/R78-922617-3) Avail: NTIS HC A05/MF A01 CSCL 20/6

This paper presents the results of an analysis of plasma properties in an electron-beam controlled KrF laser discharge. In this study special emphasis is placed on establishing the relationship among the numerous kinetic processes influencing the populations of excited specimens in the laser medium. Important reactions controlling the coupled populations of rare-gas metastable states and higher excited states are discussed in detail, along with the resultant effect of these reactions of KrF formation efficiency. It is shown that the rare-gas monohalide production efficiency is approximately 20 percent under typical conditions, and that no single reaction dominates either production or loss of KrF. In addition, the very important role of halogen molecule dissociation is treated and the resultant effects of dissociation on the temporal variations of plasma properties and on plasma stability are analyzed. Reprints of related publications are included in the Appendix to this report. Author (GRA)

N78-32408# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ANALYSIS AND COMPARISON OF MODULATION SCHEMES FOR A LASER LINE SCAN SYSTEM AT 10.6 MICRONS M.S. Thesis
Willie B. Townsend Dec. 1977 75 p refs
(AD-A055641; AFIT/GEO/EE/77-7) Avail: NTIS HC A04/MF A01 CSCL 17/5

This paper provides background information to aid in the application of carbon dioxide lasers and optical heterodyne receivers to a proven target recognition and reconstruction technique. Specifically this paper weighs the feasibility of using various modulation schemes to provide the required range information. Analysis of the performance of various signal types indicate that signals of equal energy and equal bandwidth provide the same degree of estimation accuracy, because this selection of a modulation scheme is in this case influenced mainly by complexity of system operation associated with the modulation scheme. Sinusoidal AM requires the least system complexity of all the signals considered and is therefore a good choice for near-term implementation of the subject ranging technique. The object of this study is a proposed airborne ranging system which will scan an extended ground target providing target to aircraft range information with high angular resolution. The transmitter will scan a path transverse to the flight path and upon reaching the lateral limit, return to the original position. In this manner the transmitter covers a large path of the terrain as it flies. The receiver will measure and record the transmitter to target range at regular points along the lateral scan. GRA

N78-32409# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
CHARACTERIZATION OF HIGH POWER GaAs LASERS M.S. Thesis
Daniel J. Murawinski Dec. 1977 67 p refs
(AD-A055419; AFIT/GEP/PH/77-9) Avail: NTIS HC A04/MF A01 CSCL 20/5

High power, cryogenically operated, dual cavity, ternary heterostructure, GaAs lasers are characterized under CW and 25 MHz RF current modulation conditions. The CW characteristics that are measured include: power, spectral, spatial, and temporal characteristics. It is calculated that degradation of one cavity will cause complete laser failure when the laser is operated near maximum rated drive current due to the dual cavity structure of these devices. RF current modulation at 25 MHz causes the lasers to fail within a few hours, although the same lasers exhibited stable operation under CW drive conditions. It is postulated that the piezoelectric effect in the GaAs material causes the rapid degradation, but further refinements in the calculation of the shear force present in the GaAs material is needed before definite conclusions can be made. The increase in the average output power of the GaAs lasers, operated with RF current modulation, is empirically related to the AC input power of the signal, but the mechanism by which this can occur is not understood.
Author (GRA)

N78-32410# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A MATRIX APPROACH TO A PROPAGATION CODE M.S. Thesis
Peter Leonard Misuinas Dec. 1977 46 p refs
(AD-A055463; AFIT/GEO/PH/77-1) Avail: NTIS HC A03/MF A01 CSCL 20/5

A transfer matrix for CO2 laser beams with an assumed gaussian intensity distribution is developed that includes parameters for absorption, turbulence, and thermal blooming. Calculated parameters are an effective beam radius 1/sq e point and an on-axis intensity. For moderate power levels, results are consistent with the computer code combo. The blooming model predicts results worse than those predicted by combo for high power levels. Author (GRA)

N78-32411# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
EFFECTS OF NEUTRON RADIATION ON ALUMINUM-GALLIUM-ARSENIDE LASERS M.S. Thesis
Thomas Edward Walsh, Jr. Mar. 1978 65 p refs
(AD-A055627; AFIT/GNE/PH/78-11) Avail: NTIS HC A04/MF A01 CSCL 18/8

Double heterojunction aluminum-gallium-arsenide laser diodes were irradiated in a nuclear reactor to determine the effects of neutron radiation. Two types of lasers were used; both types of diodes showed significant decreases in power output at neutron fluences of 10 to the 14th power n/sq cm. Linear increases in

threshold current and linear decreaces in external quantum efficiency were observed. There was no significant change in bias voltage versus forward current or in the spectral composition of the output of the diodes at neutron fluences up to 10 to the 15th power n/sq cm. Formulas were developed to predict the changes in threshold current, external quantum efficiency and power at a constant current above threshold. Damage coefficients for these formulas were derived from the irradiation data. Unusual discontinuities were observed in the power output versus input current curves of some diodes. Neutron irradiation tended to enhance these anomalies. GRA

N78-32412# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

LASER TEST RANGE PROPAGATION MODEL M.S. Thesis

William Hugh MacInnis Dec. 1977 168 p refs

(AD-A055639; AFIT/GEP/PH/77-6) Avail: NTIS HC A08/MF A01 CSCL 20/5

A model is described which calculates the irradiance probability distribution at the receiver of a system consisting of a co-located laser transmitter and receiver, with the beam being reflected from a small, highly reflective target. The beams considered have short pulses (10 nsec) at low rates (30 Hz). Atmospheric effects included are molecular scattering and absorption, aerosol extinction and turbulence. It is found that, in normal daytime weather conditions, it is common to have pulse-to-pulse irradiance variations at the receiver of two orders of magnitude. Author (GRA)

N78-32413# National Bureau of Standards, Washington, D. C.

LASER INDUCED DAMAGE IN OPTICAL MATERIALS: 1977

Alexander J. Glass and Arthur H. Guenther Dec. 1977 467 p refs Presented at the 9th Ann. Symp. on Opt. Mater. for High Power Lasers, Boulder, Colo., 4-6 Oct. 1977

(AD-A055498; NBS-SP-509) Avail: NTIS MF A01; SOD HC $6.75 CSCL 20/6

The Ninth Annual Symposium on Optical Materials for High Power Lasers was divided into sessions concerning Laser Windows and Materials, Mirrors and Surfaces, Thin Films, Laser Glass and Glass Lasers, and Fundamental Mechanisms. Particular emphasis was given to materials for use from 10.6 micrometers to the UV region. Highlights included surface characterization, thin film-substrate boundaries, and advances in fundamental laser-matter threshold interactions and mechanisms. The scaling of damage thresholds with pulse duration, focal area, and wavelength were also discussed. GRA

N78-32414# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.

LONG-TERM LASER FREQUENCY STABILIZATION USING A MOLECULAR BEAM Final Report, 1 Jan. 1976 - 31 Dec. 1977

Shaoul Ezekiel 2 May 1978 21 p refs

(Contract F44620-76-C-0079)

(AD-A055841; AFOSR-78-1105TR) Avail: NTIS HC A02/MF A01 CSCL 07/4

The aim of the research program was the long-term stabilization of the frequency of the 5145 A argon ion laser by using an I2 resonance, observed in a molecular beam, as a reference. The major accomplishments and the status of the program are outlined below. The 5145 A argon ion laser has been locked to a hyperfine transition in a molecular beam of I2. Two methods were used to measure the long-term frequency drift. The first method is the simpler one, and only requires one additional molecular beam apparatus. Here, the laser frequency drift is monitored by measuring the shift of the laser frequency with respect to the center of the same I2 transition observed in an independent molecular beam. In the second and more conventional method, two argon lasers are independently stabilized to adjacent I2 transitions in independent molecular beams. The two laser outputs are mixed on a fast photodiode, and the resulting beat frequency gives an accurate measure of frequency stability. Both methods yielded similar results; i.e., better than one-part-in 10 to the 13th power in an integration time of about 100 seconds. This was the highest stability achieved in the visible region of the spectrum at the time the measurements were made. The shift in the stabilized laser frequency as a function of laser intensity was found to be less than two-parts-in 10 to the 14th power for a 1% change in laser intensity at 1 mW. This value is still an upper limit at present, pending a more detailed study. GRA

N78-32415# California Univ., Livermore. Lawrence Livermore Lab.

CALORIMETRIC MEASUREMENTS OF LASER ENERGY AND POWER, 1977 SUPPLEMENT

S. R. Gunn 10 Oct. 1977 15 p refs

(Contract W-7405-eng-48)

(UCRL-51873-Suppl-1) Avail: NTIS HC A02/MF A01

The use of calorimeters for measuring laser output energies and powers is reviewed, primarily for the period 1975 to 1977. ERA

N78-32416# California Univ., Livermore. Lawrence Livermore Lab.

THE 25 MEGAJOULE ENERGY STORAGE AND DELIVERY SYSTEM FOR THE SHIVA LASER

W. L. Gagnon, P. R. Rupert, L. Berkbigler, B. M. Carder, D. G. Gritton, R. W. Holloway, M. M. Howland, and K. Whitham 18 Oct. 1977 24 p refs Presented at 7th Symp. on Fusion Res. Project, Knoxville, Tenn., 25 Oct. 1977

(Contract W-7405-eng-48)

(UCRL-79700; Conf-771029-115) Avail: NTIS HC A03/MF A01

A 20 kV capacitive energy storage and delivery system was built and tested for Shiva-a 20 arm, 10 kJ, 20 TW neodymium glass fusion research laser. This system supplies over 3.5 megamperes to xenon flashlamps for optical pumping of the laser amplifier. About 15% of the energy is used to establish magnetic fields within Faraday rotator glass. A digital based control and diagnostics scheme is employed through the entire pulse power system. This scheme utilizes a distributed digital data bus that addresses every element through two levels of optical isolation. The interfacing of low level digital circuitry to a pulse power environment is discussed, as well as the design and performance of the total system. The projected cost goal of 27 cents/joule, installed and operating was met. The general approach to the design, transient analysis, manufacture, and activation of this large power conditioning system is also discussed. ERA

N78-32417# California Univ., Livermore. Lawrence Livermore Lab.

ACCELERATION OF SOLID MACRO-PARTICLES BY LASER PRODUCED ABLATION

T. E. McCann (Calif. Univ., Davis) and J. S. DeGroot 20 Sep. 1977 19 p refs Presented at the 19th Meeting of the Am. Phys. Soc., Atlanta, 6-11 Nov. 1977

(Contract W-7405-eng-48)

(UCRL-79732; Conf-771136-21) Avail: NTIS HC A02/MF A01

Laser acceleration of small (mass of order 1 gram) solid particles was computationally analyzed. Acceleration was caused by a one sided laser illumination of a solid particle producing heating of the material, an ablation wave and the resulting ablative reaction force. Laser intensity was constrained to produce an ablation pressure less than the yield strength of the material. Preliminary results indicate the possibility of converting absorbed laser energy to solid density kinetic energy with an efficiency greater than 10 percent. Results of LASNEX calculations and comparison with an anallytical model are presented which characterize the physics important to the process. ERA

N78-32418# Los Alamos Scientific Lab., N. Mex.

LAPUZ: A LASER PULSE PROPAGATION CODE WITH DIFFRACTION

John C. Goldstein and D. O. Dickman Mar. 1978 79 p refs

(Contract W-7405-eng-36)

(LA-6955) Avail: NTIS HC A04/MF A01

Complete descriptions of the mathematical models and numerical methods used in the code LAPUZ are presented. This code can be used to study the propagation with diffraction of a temporally finite pulse through a sequence of resonant media and simple optical components. The treatment assumes cylindrical symmetry and allows nonlinear refractive indices. An unlimited

number of different media can be distributed along the propagation path of the pulse. A complete users guide to input data is given as well as a FORTRAN listing of the code. ERA

N78-32419# National Technical Information Service, Springfield, Va.
LIGHT DETECTION AND RANGING (LIDAR), VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1975 - Jun. 1978
Mona F. Smith Jun. 1978 3 p Supersedes NTIS/PS-77/0545, NTIS/PS-76/0429; NTIS/PS-75/402; COM-73-11719 (NTIS/PS-78/0640/9; NTIS/PS-77/0545; NTIS/PS-76/0429; NTIS/PS-75/402; COM-73-11719) Avail: NTIS HC $28.00/MF $28.00 CSCL 17H

The majority of studies are concerned with LIDAR applications, such as atmospheric sounding, atmospheric visibility, atmospheric transmissivity, air and water pollution detection, personnel and vehicle detection and lenses, lasers, and adaptive optics are also included. GRA

N78-32420# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY: BIOMEDICAL AND BEHAVIORAL SCIENCES, NO. 41
7 Aug. 1978 41 p refs Transl. into ENGLISH from various Russian journals
(JPRS-71628) Copyright Avail: NTIS HC A03/MF A01

A description is given of the U.S.S.R.'s use of laser technology in medicine; specifically in treating skin diseases, glaucoma and diseases of vascular tissue. For individual titles, see N78-32421 through N78-32423.

N78-32421# Joint Publications Research Service, Arlington, Va.
BIOLOGICAL BARRIER ON SURFACE OF A LASER INCISION
S. D. Pletnev, M. Sh. Abdurazakov, and O. M. Karpenko *In its* Transl. on USSR Sci. and Technol.: Biomed. and Behavioral Sci., No. 41 (JPRS-71628) 7 Aug. 1978 p 24-28 refs Transl. into ENGLISH from Khirurgiya (Moscow), no. 4, 1978 p 99-102 (For primary document see N78-32420 23-36)
Copyright. Avail: NTIS HC A03/MF A01

It was noted that the surface of the wound inflicted by the beam scalpel was covered with necrotic masses in the form of a thin coagulating film. Visual followups on the animals operated upon suggests that the given coagulating film is a type of biological barrier which prevents the contents of the wound from penetrating into the surrounding healthy tissues. The results of the studies indicate that the zone of coagulating necrosis which is found on the surface of a laser incision can be considered a biological barrier, which prevents the penetration of dye (trypan blue) into the morphologically preserved tissues. L.S.

N78-32422# Joint Publications Research Service, Arlington, Va.
COMPARATIVE EVALUATION OF THE DAMAGING ACTION OF RUBY CRYSTAL Q-SWITCHED AND ARGON LASERS ON FILTRATION APPARATUS
M. M. Krasnov, G. G. Ziangirova, V. S. Akopyan, and G. G. Litvinova *In its* Transl. on USSR Sci. and Technol.: Biomed. and Behavioral Sci., No. 41 (JPRS-01628) 7 Aug. 1978 p 34-44 refs Transl. into ENGLISH from Vestn. Oftalmol. (Moscow), no. 3, 1978 p 22-29 (For primary document see N78-32420 23-36)
Copyright. Avail: NTIS HC A03/MF A01

In a comparative study on the damaging action of the ruby crystal Q-switched and argon lasers on the tissue of the drainage system of enucleated eyes, a varying mechanism was revealed for their action. The ruby crystal Q-switched laser was characterized by a greater damaging capability than the argon laser, which is combined with the commotio syndrome along the periphery of the focus of direct action of the laser beam. In a study of the damaging effect of the argon laser in a glaucomatous eye the need was found for a more careful study of laser action on the changed pathological processes of the tissue, in particular on the altered and thickened trabecula. The degree of absorption of laser radiation depends, evidently, not only on the degree of tissue pigmentation, but also on the characteristics of the proteins comprising it. L.S.

N78-32423# Joint Publications Research Service, Arlington, Va.
FLUORESCENT ANGIOGRAPHY AND ARGON-LASER COAGULATION IN THE GRONBLAD-STRANDBERG SYNDROME
E. G. Yeliseyeva, V. G. Dimitrova, N. N. Podgornaya, and O. K. Pereverzina *In its* Transl. on USSR Sci. and Technol.: Biomed. and Behavioral Sci., No. 41 (JPRS-71628) 7 Aug. 1978 p 45-49 refs Transl. into ENGLISH from Vestn. Oftalmol. (Moscow), no. 3, 1978 p 30-32 (For primary document see N78-32420 23-36)
Copyright. Avail: NTIS HC A03/MF A01

Fluorescent angiography was found to be a valuable diagnostic method that makes it possible to find latent starting, ophthalmoscopically invisible changes on the fundus oculi of a secondary nature, especially their localization in the macular region, by expanding the indications for the use of argon laser coagulation. It was possible to evaluate the dynamics of the process, especially with the use of argon laser coagulation. Argon laser coagulation seemed promising in the stabilization of the process, especially in the early stages. L.S.

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N78-32424 Virginia Univ., Charlottesville.
DYNAMIC ANALYSIS OF FLEXIBLE ROTOR-BEARING SYSTEMS USING A MODEL APPROACH Ph.D. Thesis
Kat Chung Choy 1977 379 p
Avail: Univ. Microfilms Order No. 7812107

The generalized dynamic equations of motion were obtained by the direct stiffness method for multimass flexible rotor-bearing systems including the effects of unbalance, shaft bow, disk skew, rotor acceleration, gyroscopic moments, and nonlinear bearing forces. The use of undamped and damped system mode shapes in the transformation are discussed. A set of undamped critical speed modes is used to transform the equations of motion into a set of coupled modal equations of motion. A rapid procedure for computing stability, steady state unbalance response, and transient response is presented. Examples of the application of this modal approach are presented. The dynamics of the system is further investigated with frequency spectrum analysis of the transient response through the use of numerical fast Fourier transformations. Dissert. Abstr.

N78-32425 Houston Univ., Tex.
IMPROVEMENTS TO MECHANISM: SYNTHESIS METHODS Ph.D. Thesis
Robert Thomas Strong 1978 185 p
Avail: Univ. Microfilms Order No. 7816216

The order, branch and Grashof problems have been a source of frustration for linkage designers for many years. A simplified procedure is presented for the elimination of the order and branch problems. This new theory is then applied to the inverted four-bar linkage resulting in further improvements in the design of crank-rocker linkages. Also included is a numerical algorithm for the application of these results to numerical linkage synthesis. Dissert. Abstr.

N78-32426*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AUTOMOTIVE FUEL ECONOMY AND EMISSIONS PROGRAM Final Report, Jun. 1975 - Dec. 1976
Mack W. Dowdy and Ronald L. Baisley Jun. 1978 209 p refs Sponsored in part by NASA
(Contract DOT-RA75-41)
(NASA-CR-157604; JPL-Pub-78-21) Avail: NTIS HC A10/MF A01 CSCL 13I

Experimental data were generated to support an assessment of the relationship between automobile fuel economy and emissions control systems. Tests were made at both the engine and vehicle levels. Detailed investigations were made on cold-start

emissions devices, exhaust gas recirculation systems, and air injection reactor systems. Based on the results of engine tests, an alternative emission control system and modified control strategy were implemented and tested in the vehicle. With the same fuel economy and NOx emissions as the stock vehicle, the modified vehicle reduced HC and CO emissions by about 20 percent. By removing the NOx emissions constraint, the modified vehicle demonstrated about 12 percent better fuel economy than the stock vehicle. G.G.

N78-32427*# National Aeronautics and Space Administration, Washington, D. C.
CHEVRON CUTTING: EXPERIMENT WITH NEW RUNWAY MIXTURES
K. Tyran, comp. Sep. 1978 31 p Transl. into ENGLISH of "Chevron Cutting: Versuch mit neuen Laufflaechenmischungen", Rept. Publ-72-758 Swissair, Zurich, 22 Dec. 1977 20 p Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75448; Publ-72-758) Avail: NTIS HC A03/MF A01 CSCL 11J

Chevron cutting is shown to occur in different forms depending on the type of tire and the rubber on the running surface. Hardest wear is shown by the main tires of the B-747. Four defects occurred, in the form of two rip separation and two breakouts of the running surface. Tires capped by Thompson are more affected than any of the other rubber-capping fabrics. For Thompson tires, Chevron Cutting is greatly reduced with a fiberglass-rubber mixture. For Goodyear tires, it is eliminated with spiral wrap rubbercapping; resistance to damages through cuts seems to be more positive for Goodyear tires. For Mader tires, the extent of Chevron Cutting is generally smaller than for Thompson cappings. J.M.S.

N78-32428*# National Aeronautics and Space Administration, Washington, D. C.
MAGNETIC FIELD IN THE AIR GAP OF A HYSTERESIS CLUTCH WITH CYLINDRICAL ROTOR
Yu. A. Yermolin May 1978 9 p refs Transl. into ENGLISH from Elektrichestvo (USSR), no. 8, 1971 p 63-66 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(NASA-TM-75183) Avail: NTIS HC A02/MF A01 CSCL 13I

Equations are derived for the approximate calculation of the air gap configuration of a hollow-rotor clutch. Author

N78-32429*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
BELT FOR COUPLING DRIVEN MEMBERS Patent Application
Hossein Bahiman, inventor (to NASA) Filed 22 Aug. 1978 10 p
(NASA-Case-GSC-12276-1; US-Patent-Appl-SN-935811) Avail: NTIS HC A02/MF A01 CSCL 13I

An invention is offered which relates to drive belts for coupling driving and driven members where the belts cannot be easily replaced. Such belts should be sufficiently flexible to conform to the curvature of the driving and driven members, sufficiently immune to stretching to thereby prevent slippage, and sufficiently immune to degradation when subjected to harsh environmental conditions to insure long life of the belt. This invention has potential application in all types of spacecraft using belt drive systems and in environments such as mining and other hazardous situations where belt replacement would be difficult if not impossible. NASA

N78-32430*# Technion - Israel Inst. of Tech., Haifa.
RADIAL FORCES IN A MISALIGNED RADIAL FACE SEAL Final Report
I. Etsion Aug. 1977 27 p refs
(Grant NsG-7317)
(NASA-CR-135243; TME-312) Avail: NTIS HC A03/MF A01 CSCL 11A

Radial forces on the primary seal ring of a flat misaligned seal are analyzed, taking into account the radial variation in seal clearance. An analytical solution for both hydrostatic and hydrodynamic effects is presented that covers the whole range from zero to full angular misalignment. The net radial force on the primary seal ring is always directed so as to produce a radial eccentricity which generates inward pumping. Although the radial force is usually very small, in some cases it may be one of the reasons for excessive leakage through both the primary and secondary seals of a radial face seal. Author

N78-32431*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
A FLOATING NUT RETENTION SYSTEM Patent Application
James F. Charles (Rockwell International) and Harry Theakston, inventors (to NASA) (Rockwell International) Filed 31 Aug. 1978 12 p
(Contract NAS9-14000)
(NASA-Case-MSC-16938-1; US-Patent-Appl-SN-938582) Avail: NTIS HC A02/MF A01 CSCL 20I

The nut was secured to an innerretainer plate with the nut aperture being aligned with the inner retainer plate opening. An outer retainer base plate with an opening was placed adjacent to the surface of the inner retainer in such a way that it floats and forms a bearing surface for the inner retainer plate. The radial flow prevents misalignment in high torque applications. NASA

N78-32432*# California State Univ., Northridge.
ROLLER TO SEPARATOR CONTACT FORCES AND CAGE TO SHAFT SPEED RATIOS IN ROLLER BEARINGS Final Report
Lester J. Nypan Sep. 1978 73 p refs
(Grant NsG-3065)
(NASA-CR-3048) Avail: NTIS HC A04/MF A01 CSCL 13I

Cage to roller force measurements, cage to shaft speed ratios are reported for 115- and 118-mm bore roller bearings operating at speeds of 4000, 8000, and 12,000 rpm under loads ranging from 360 to 6670 N (80 to 1500 lb). Author

N78-32433*# Tennessee Univ. Space Inst., Tullahoma.
TRANSIENT DYNAMICS OF A FLEXIBLE ROTOR WITH SQUEEZE FILM DAMPERS Final Report
D. F. Buono, L. D. Schlitzer, R. G. Hall, III, and D. H. Hibner Sep. 1978 85 p refs
(Contract NAS3-18523)
(NASA-CR-3050; PWA-5548-9) Avail: NTIS HC A05/MF A01 CSCL 13I

A series of simulated blade loss tests are reported on a test rotor designed to operate above its second bending critical speed. A series of analyses were performed which predicted the transient behavior of the test rig for each of the blade loss tests. The scope of the program included the investigation of transient rotor dynamics of a flexible rotor system, similar to modern flexible jet engine rotors, both with and without squeeze film dampers. The results substantiate the effectiveness of squeeze film dampers and document the ability of available analytical methods to predict their effectiveness and behavior. G.G.

N78-32434*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
SPRAY COATING APPARATUS HAVING A ROTATABLE WORKPIECE HOLDER Patent Application
Marnell Smith, Victor W. Katvala, and Ernest E. Porter, inventors (to NASA) Filed 22 Sep. 1978 12 p
(NASA-Case-ARC-11110-1; US-Patent-Appl-SN-945040) Avail: NTIS HC A02/MF A01 CSCL 13H

A spray coating apparatus is described for rotating a workpiece relative to a spray station to obtain a uniform coating of the workpiece. The apparatus for rotating the workpiece includes a base support with a rotatable stage for rotation in the horizontal plane and a rotatable stage for rotation in a second plane inclined at an angle to the horizontal plane. The workpiece is rotatable in both of two planes of rotation. The workpiece support is detachable from the first rotatable stage and the workpiece is readily detachable from the workpiece support to facilitate off loading of the spray coated workpiece. The workpiece holder includes a spray guard extending around the periphery of the workpiece to shield that surface of the workpiece where no coating is desired. The two degrees of freedom provided in the rotation of the workpiece relative to the spray station permits the various facets of the ceramic tile to be sequentially rotated

into an orthogonal relationship to the spray station for uniform coating. NASA

N78-32435*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
BELT FOR TRANSMITTING POWER FROM A DRIVING MEMBER TO A DRIVEN MEMBER Patent Application
Hossein Bahiman, inventor (to NASA) Filed 18 Sep. 1978 10 p
(NASA-Case-GSC-12289-1; US-Patent-Appl-SN-943086) Avail: NTIS HC A02/MF A01 CSCL 13I

A belt for transmitting power from one wheel sprocket to another is described for use in spacecraft, permanently encased equipment, equipment used in tunnel and mine shafts, and sealed machines. The belt has flexible teeth spaced along the direction of its travel. Each of the teeth has a longitudinal axis transverse to the direction of belt travel. The belt also includes inextensible fasts spaced transversely to the direction of the belt travel. The fasts extend in the direction of belt travel adjacent to the teeth and are looped around preselected numbers of the teeth. NASA

N78-32436*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ANTENNA DEPLOYMENT MECHANISM Patent Application
William A. Leavy and Charles Russell Griffin, inventors (to NASA) Filed 18 Sep. 1978 19 p
(NASA-Case-GSC-12331-1; US-Patent-Appl-SN-943088) Avail: NTIS HC A02/MF A01 CSCL 13I

A mechanism is described for the powered deployment of an antenna mast on a spacecraft or the like and for caging or latching the mast in a retracted position. A redundant drive rotates a drum to reel in a cable for deploying a multi-section telescoping antenna mast. The drum is releasably coupled through a fork device for the ratchet serving to lock the antenna mast in a deployed position. A spring biased latching or caging mechanism for the interior mast section includes cam operated latch bolts and cooperating interfitting latch elements mounted for relative movement in the base of mast section. A rigid terminal tube for the cable drives the mast section toward its deployed position through engagement with tunnel slots in the latch components. The caging means releases and engages automatically by cam action. NASA

N78-32437# Southwest Research Inst., San Antonio, Tex. Army Fuels and Lubricants Research Lab.
APPRAISAL OF EXTENDED OIL DRAIN INTERVALS THROUGH THE USE OF ENGINE OR LUBRICANT FORMULATION MODIFICATIONS Interim Report
E. C. Owens, S. J. Lestz, and R. D. Quillian, Jr. May 1978 130 p refs
(Contracts DAAK70-78-C-0001; DAAG53-76-C-0003)
(AD-A055923; AFLRL-99) Avail: NTIS HC A07/MF A01 CSCL 11/8

Four engine tests were conducted to evaluate potential methods to increase the periods between required engine oil drains for military vehicles. A 300-hour duration dynamometer test of an L-141 spark ignition engine showed that the use of a synthetic based MIL-L-46152 qualified lubricant with special low blowby piston rings resulted in low lubricant degradation rates. This performance, coupled with the wider temperature operation limits of the multiviscosity lubricant, shows promise of allowing greatly extended lubricant drain intervals. The test also showed a previously unobserved loss in blowby control with increasing test hours which may hint at a lubricant/material compatibility problem, clouding the otherwise excellent results. GRA

N78-32438# Detroit Diesel Allison, Indianapolis, Ind.
CONTROL FEASIBILITY STUDY FOR THE JOINT TECHNOLOGY DEMONSTRATOR ENGINE Final Technical Report, May 1976 - Jan. 1977
John A. Weber, K. A. Pieper, R. C. Boyer, F. J. Okeefe, and R. C. Thomas Oct. 1977 95 p
(Contract F33657-76-C-0021; AF Proj. 668A)
(AD-A055607; DDAD-EDR-9089; AFAPL-TR-77-57) Avail: NTIS HC A05/MF A01 CSCL 21/5

This report documents a program which demonstrated the feasibility of using a Bendix Model EH-K1 digital controller to operate the gas generator portion of a Joint Technology Demonstrator engine. The control modes were developed by Detroit Diesel Allison, Division of GMC, to achieve optimal specific fuel consumption and safe engine operation. A digital simulation of the control modes was interfaced with a digital simulation of the engine to determine schedules and compensation. The Energy Controls Division of Bendix Corporation, as subcontractor to Detroit Diesel Allison, then coded the control modes to be compatible with the EH-K1 instruction set. The software was tested on a ground-based version of the EH-K1 interfaced to a simplified, linear analog engine model. The testing demonstrated stable engine operation using the defined control modes. Author (GRA)

N78-32439# Signatron, Inc., Lexington, Mass.
ADAPTIVE ANTENNA CONTROL SYSTEM Interim Technical Report, 25 Dec. 1976 - 25 Sep. 1977
Peter Monsen and Steen Parl Feb. 1978 170 p refs Prepared in cooperation with RF Systems, Inc., Cohassett, Mass.
(Contract DAAB07-76-C-8085)
(AD-A055820; A212-2; ITR-2; ECOM-76-8085-2) Avail: NTIS HC A08/MF A01 CSCL 09/5

This interim technical report contains a tropospheric system prediction model which can be used to predict median path loss, aperture to medium coupling loss, and 2 sigma multipath spread. The prediction model is used to determine design parameters for an angle diversity system. For a dual vertical angle diversity system the optimum beam separation is approximately 1 beamwidth and the antenna take-off angle relative to the horizon is approximately 1/2 beamwidth for C-band systems and 1/4 beamwidth for L-band systems. An analysis of long term variability and the decorrelation advantage of angle diversity is presented along with preliminary results. The prediction model is used to compare 3 specific troposcatter system examples with the result that dual space/dual angle diversity is superior in system performance over conventional dual space/dual frequency diversity. The dependence of aperture-to-medium coupling loss on carrier frequency is also investigated. The turbulent scatter theory used in the model analysis suggests that conversion of L-band systems to S-band would result in significant system improvement. Further study of available empirical data is required to validate this result. Author (GRA)

N78-32440# Air Force Packaging Evaluation Agency, Wright-Patterson AFB, Ohio.
PERFORMANCE EVALUATION OF A POLYETHYLENE FOAM SHIPPING CONTAINER FOR THE F-16 EMERGENCY POWER UNIT HYDRAZINE FUEL TANK
James D. Heck and Frank C. Jarvis Apr. 1978 15 p
(AD-A055717; PTPT-78-12) Avail: NTIS HC A02/MF A01 CSCL 13/4

In support of ASD/AEGT, this Agency subjected a prototype polyethylene foam container for the F-16 Emergency Power Unit (EPU) hydrazine fuel tank, to a series of performance tests in accordance with Federal Test Method Standard 101B. The objective of these tests was to determine if the prototype container would protect the EPU fuel tank from mechanical damage and maintain a vapor seal, i.e., a minimum 1.0 psig pressure during all phases of testing. The container was subjected to repetitive shock and vibration, compression loading, free fall drop (ambient and low temperature), and leak tests. These tests indicate the EPU container will maintain the 25 G shock protection level required during all phases of transportation. However, the container gasket seal failed to maintain the prescribed pressure during all phases of testing. Author (GRA)

N78-32441# Air Force Packaging Evaluation Agency, Wright-Patterson AFB, Ohio.
PERFORMANCE OF A HIGH DENSITY POLYURETHANE SHIPPING CONTAINER FOR THE F-16 EMERGENCY POWER UNIT HYDRAZINE FUEL TANK Interim Report
Franck C. Jarvis and James D. Heck 1 May 1978 12 p refs
(AD-A055733; PTPT-78-11) Avail: NTIS HC A02/MF A01 CSCL 13/4

In support of ASD/AEGT this Agency subjected a candidate prototype polyurethane container for the F-16 Emergency Power Unit (EPU) Hydrazine Fuel Tank, to a series of performance tests in accordance with Federal Test Method Standard 101 B.

The objective of these tests was to determine if the prototype container would protect the EPU fuel tank from mechanical damage and maintain a vapor seal, i.e. a minimum 1.0 psig pressure during all phases of testing. The container was subjected to compression loading, free fall drop tests (ambient and low temperature), pneumatic pressure, and leak tests in accordance with Methods 5016, 5007, and 5009, respectively. These tests indicated the EPU fuel tank container will maintain a positive seal under 1.0 psig pressure and remain intact throughout environmental and transportation rough handling tests. The container did not meet the 25 G shock protection requirement.
Author (GRA)

N78-32442# Welding Inst., Cambridge (England).
FEASIBILITY STUDY OF WELD METAL GRAIN REFINEMENT USING PULSED WIRE FEED SPRAY MIG WELDING Final Report, 2 Jul. 1976 - Jan. 1978
P. L. Threadgill Jan. 1978 38 p refs
(Grant DA-ERO-76-G-055)
(AD-A055734; Rept-3525/2/78) Avail: NTIS HC A03/MF A01 CSCL 13/8

In this work, the prospects of achieving an equiaxed or refined weld metal microstructure in ferritic steels using the pulsed wire feed spray MIG process have been investigated. Despite the large number of pulse conditions used, equiaxed solidification has in general been confined only to the weld root regions. It is suggested that the process is most likely to succeed at high pulse frequencies, but is prevented from doing so by thermal inertia effects at these frequencies. Author (GRA)

N78-32443# Department of Energy, Bartlesville, Okla. Energy Research Center.
INVESTIGATIVE STUDY OF ENGINE LIMITING
R. L. Bechtold Feb. 1978 19 p refs
(BERC/RI-77/13) Avail: NTIS HC A02/MF A01

The effect of cylinder cut-out or engine limiting on fuel consumption and exhaust emissions for a V-type 8-cylinder engine was determined. Increases in energy conversion efficiency while operating with only 4 cylinders ranged from 10 to 40% compared to operation with 8 cylinders at the same power outputs. The speeds and loads chosen were representative of those required to operate a 4,500-lb vehicle at speeds up to 60 mph. Hydrocarbon emissions increased at low speed/load points under 4 cylinder operation. An insignificant change in carbon monoxide emissions was observed while an increase in oxides of nitrogen emissions resulted at the higher speed/load points. ERA

N78-32444# Oak Ridge National Lab., Tenn.
INTERNAL COMBUSTION PISTON ENGINES
Charles L. Segaser Jul. 1977 85 p refs
(Contract W-31-109-eng-38)
(ANL/CES/TE-77-1) Avail: NTIS HC A05/MF A01

Current worldwide production of internal combustion piston engines includes many diversified types of designs and a very broad range of sizes. Engine sizes range from a few horsepower in small mobile units to over 40,000 brake horsepower in large stationary and marine units. The key characteristics of internal combustion piston engines considered appropriate for use as prime movers in Integrated Community Energy Systems are evaluated. The categories of engines considered include spark ignition gas engines, compression ignition oil (diesel) engines, and dual fuel engines. The engines were evaluated with respect to full load and part load performance characteristics, reliability, environmental concerns, and estimated 1976 cost data. ERA

N78-32445# Mechanical Technology, Inc., Latham, N. Y.
CHARACTERIZATION STUDY OF AN ELECTRIC MOTOR-TRANSMISSION SYSTEM FOR ELECTRIC VEHICLES
A. Marcus and O. Pinkus Sep. 1977 112 p refs
(Contract EY-76-C-02-2835)
(COO-2835-2; MTI-78TR2) Avail: NTIS HC A06/MF A01

A unique electric transmission concept, consisting of two traction motors in tandem, for use in automotive vehicles is described. The device does away with the requirement of intermittent current supply at low speeds, and is shown to be superior to conventional electric motor drives with regard to efficiency flexibility of torque-speed requirements, control, and adaptability to regenerative braking. A detailed study of a 7.5 kW model was performed, providing performance data, current drain, output, efficiencies, and other relevant system characteristics. Based on this data, a preliminary design is formulated including estimates of size, weight, and cost. A catalog of specifications for power ratings ranging from 3.7 kW to 15 kW is included, so that the automotive designer may select a unit most appropriate to his vehicle. ERA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N78-32446 George Washington Univ., Washington, D. C.
SOME CONTRIBUTIONS TO THE METHODOLOGY FOR ANALYZING FAILURE DATA Ph.D. Thesis
Mahesh Chandra 1978 66 p
Avail: Univ. Microfilms Order No. 7814303

The problem of failure data analysis is examined. The contributions of the study can be classified into two broad categories. In the first category is the development of some goodness-of-fit tests for the Weibull distribution with unknown parameters. The test statistics are functions of the empirical distribution function, and are based on an adaptation of some recent results on the theory of goodness-of-fit tests. In the second category is the proposal that the Lorenz curve methods of economic theory can also be considered for use in the analysis of failure data. Several connections are made between some well-known indicators in economic theory and a central concept in reliability theory. These connections, made between the two apparently different disciplines, constitute an important contribution of the study. Dissert. Abstr.

N78-32447* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
HYBRID HOLOGRAPHIC NON-DESTRUCTIVE TEST SYSTEM Patent
Robert L. Kurtz, inventor (to NASA) Issued 6 Jun. 1978 9 p Filed 14 May 1976 Supersedes N76-24529 (14 - 15, p 1929)
(NASA-Case-MFS-23114-1; US-Patent-4,093,382; US-Patent-Appl-SN-686331; US-Patent-Class-356-72; US-Patent-Class-73-603; US-Patent-Class-350-3.5; US-Patent-Class-356-73) Avail: US Patent Office CSCL 14D

An automatic hybrid holographic non-destructive testing (HNDT) method and system capable of detecting flaws or debonds contained within certain materials are described. This system incorporates the techniques of optical holography, acoustical/optical holography and holographic correlation in determining the structural integrity of a test object. An automatic processing system including a detector and automatic data processor is used in conjunction with the three holographic techniques for correlating and interpreting the information supplied by the non-destructive systems. The automatic system also includes a sensor which directly translates an optical data format produced by the holographic techniques into electrical signals and then transmits this information to a digital computer for indicating the structural properties of the test object. The computer interprets the data gathered and determines whether further testing is necessary as well as the format of this new testing procedure. Official Gazette of the U.S. Patent Office

N78-32448*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
X-RAY ENHANCEMENT SOFTWARE DEVELOPMENT AND TEST Final Report
Robert L. Butterfield and C. L. Dillon Aug. 1978 48 p
(NASA-TM-79936; KSR-TR-1622) Avail: NTIS HC A03/MF A01 CSCL 14D

A repertoire of software to optimally analyze various X-ray imagery was successfully developed. Computer techniques are presented to solve many common problems involved in nondestructive testing X-ray analysis. Author

N78-32449# Wayne State Univ., Detroit, Mich. Dept. of Physics.
STUDIES OF ELECTROMAGNETIC SOUND GENERATION FOR NON-DESTRUCTIVE TESTING Final Technical Report
Robert L. Thomas 1 May 1978 15 p refs
(Grant AF-AFOSR-3347-77; AF Proj. 2306)
(AD-A055615; AFOSR-78-1044TR) Avail: NTIS HC A03/MF A01 CSCL 14/2

A new technique for NDE has been studied and found to have good potential for the detection of small flaws in ceramic materials. The technique utilizes photoacoustic spectroscopy. Additional studies on the use of evaporated CdS thin film transducers with contactless interdigital electrodes have been carried out. Author (GRA)

N78-32450# George Washington Univ., Washington, D. C. Inst. for Management Science and Engineering.
ACCELERATED LIFE TESTING: A PRAGMATIC BAYESIAN APPROACH
Frank Roschan 17 May 1978 24 p refs Prepared in cooperation with Florida State Univ., Tallahassee
(Contract N00014-77-C-0263; Grant AF-AFOSR-2581-74; NR Proj. 042-372)
(AD-A056097; Serial-T-375) Avail: NTIS HC A02/MF A01 CSCL 12/1

In this paper a model is proposed for accelerated life testing which differs from those considered in the past. Our model does not require the usual assumptions about the failure distributions and the accelerated functions. Our approach is Bayesian, and depends on the estimation of ordered failure rate functions at different stress levels. Since our model is nonparametric, and our approach is quite pragmatic, our results should be of use to engineers working on accelerated life tests, and biometricians involved in carcinogenic experiments. GRA

N78-32451# Oak Ridge National Lab., Tenn.
ARC-DISCHARGE SYSTEM FOR NONDESTRUCTIVE DETECTION OF FLAWS IN THIN CERAMIC COATINGS
G. W. Scott and E. V. Davis Apr. 1978 38 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6176) Avail: NTIS HC A03/MF A01

The feasibility of nondestructive detecting small cracks of or holes in plasma-sprayed ceramic coatings with an electric arc-discharge system was studied. ZrO2 coatings 0.46 mm thick on incology alloy 800 substrates were inspected. A system was designed and built to scan the specimen's surface at approximately 50 microns clearance with a sharp-pointed metal-tipped probe at high dc potential. A theoretical model of the probe-specimen circuit shows constant dc potential to be the best choice for arc-discharge inspection of insulating coatings. Experimental observations and analysis of data disclosed some potential for flaw description. ERA

N78-32452# Bureau of Radiological Health, Rockville, Md. Div. of Electronic Products.
AN INSTRUMENT FOR NON-INVASIVE mAs MEASUREMENT Final Report
Ray L. Walchle Mar. 1978 27 p refs Prepared in cooperation with World Health Organ., Geneva
(PB-280548; FDA/BRH-78/87) Avail: NTIS HC A03/MF A01 CSCL 06L

A commercially available, large aperture current probe system for the noninvasive measurement of both mAs and current was modified. The resulting instrument is suitable for the measurement of X-ray tube current and X-ray tube current time product (mAs) as required in the enforcement of the Federal performance standard for diagnostic X-ray equipment. The response of the instrument to typical X-ray tube current waveforms was investigated. The results are compared to data taken with a commercially available, invasively connected instrument. B.B.

N78-32159*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EVALUATION OF THE DEVELOPING DSN LIFE-CYCLE COST STANDARD PRACTICE
M. McKenzie *In its* The Deep Space Network 15 Aug. 1978 p 139-145 refs (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 14D

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N78-32453 Texas Technological Univ., Lubbock.
NONLINEAR ANALYSIS OF ORTHOTROPIC, LAMINATED SHELLS OF REVOLUTION BY THE FINITE ELEMENT METHOD Ph.D. Thesis
Charles Medley Eldridge 1977 107 p
Avail: Univ. Microfilms Order No. 7814003

The nonlinear analysis of an orthotropic, laminated shell of revolution with transverse shear deformations is presented. The finite element method, employing a curved shell element, was the method used to perform the analysis. Each element has two nodes with four degrees of freedom at each node, viz., two translations, one bending rotation and one transverse shear rotation. The classical Kirchhoff-Love assumption for normals to the midsurface was relaxed in favor of the shear deformation mode. A curved shell element was developed that matches slopes and curvatures, as well as displacements at the nodal circles. This significantly reduced the meridional bending moments present at element junctures, as compared to the case in which straight line elements (conical frusta) were used to represent a shell of revolution having meridional curvatures. A local rectilinear coordinate system was established for the element to represent the displacement patterns. The displacements of the curved element were represented in this local system and subsequently transferred to the global system. Dissert. Abstr.

N78-32454 California Univ., Berkeley.
INELASTIC BEHAVIOR OF ECCENTRICALLY BRACED STEEL FRAMES UNDER CYCLIC LOADINGS Ph.D. Thesis
Charles William Roeder 1977 328 p
Avail: Univ. Microfilms Order No. 7812753

A practical structural system, which possesses many advantages in the seismic design of steel structures, is described. This system employs diagonal braces with deliberately large eccentricities with respect to the beam-column joint. Short beams which initially yield in shear were tested in cyclic loading. An analytical model for predicting the behavior of such beams is developed from the test results. The inelastic model is used to perform inelastic dynamic analysis of a 20-story eccentrically-braced prototype structure. Two one-third scale model eccentrically-braced test frames were designed and tested. Design recommendations are made. Dissert. Abstr.

N78-32455 Carnegie-Mellon Univ., Pittsburgh, Pa.
SYMBOLIC GENERATION OF FINITE ELEMENT STIFFNESS MATRICES Ph.D. Thesis
Alan Richard Korncoff 1978 117 p
Avail: Univ. Microfilms Order No. 78-10411

A symbolic processor to assist in the generation of stiffness matrices for finite elements, based on a recently developed symbolic processor, is presented. Operations are performed upon element characteristics and material properties in symbolic form to produce a matrix template, consisting of the algebraic expressions generated for the stiffness coefficients as functions of the problem parameters in literal form. The template may be evaluated for a given element by binding these symbolic forms to the numerical values associated with a specific element. The evaluation process is further facilitated by permitting specifications of a variety of output formats for the resulting matrix template. Required input is minimized by automatically synthesizing the constituent matrices of the formulation from user-supplied specifications of shape functions, material properties and stress-strain relationships, all in symbolic notation. Dissert. Abstr.

N78-32456 State Univ. of New York, Buffalo.
TOWARDS THE OPTIMUM STABILITY DESIGN OF TAPERED COLUMNS Ph.D. Thesis
David Olusola Olowokere 1978 133 p
Avail: Univ. Microfilms Order No. 78-11846

The development of an efficient and economical design for

stability of structural steel members is described. A finite element method is presented to determine the elastic and inelastic lateral-torsional buckling load for linearly tapered I-members. Solutions are obtained for different flange-area ratio and tapering ratio. Both laterally supported (tension flange only) and unsupported members are considered. Furthermore, some considerations of structural optimization are used to determine the best values for the proportions of the cross-section. The optimization technique is based on a SMD (Simulation Mode Design) philosophy; the constraints being the local buckling of the web and flange elements. Dissert. Abstr.

N78-32457 Ohio State Univ., Columbus.
FORCED VIBRATION OF THIN ELASTIC SHELLS WITH APPLICATION TO FRACTIONAL HORSEPOWER HERMETIC REFRIGERATION COMPRESSOR SHELLS Ph.D. Thesis
Earl Bruce Brookbank, III 1978 212 p
Avail: Univ. Microfilms Order No. 7812323

A method for determining the differential equations of motion for thin elastic shells with various types of external loading was developed. This technique consisted of determining the generalized force from the virtual work done by the shell loading. The generalized force for many types of point, line, and distributed loadings are derived and summarized. The derivation of these equations of motion showed that the reaction force from springs, attached masses, or external dampers excite all shell vibration mode shapes and crosscouples the shell differential equations of motion for each mode shape. These differential equations were applied to a fractional horsepower hermetic refrigeration compressor. Dissert. Abstr.

N78-32458 Syracuse Univ., N. Y.
SHEAR BUCKLING OF CORRUGATED PLATES WITH QUASI-SINUSOIDAL CORRUGATIONS Ph.D. Thesis
Mirza Iqbal Hussain 1977 114 p
Avail: Univ. Microfilms Order No. 7811658

The usual approach to this problem was to idealize the corrugated plate as an orthotropic flat plate and apply the conventional techniques of flat plate buckling analysis. However, there were doubts as to the applicability of orthotropic plate theory to corrugated plates. A somewhat more refined approach was used, specifically in connection with simply supported corrugated plates of curvilinear cross section. In this approach, the corrugated plate was regarded as a shell and its buckling load was determined by the method of stationary total potential energy. On the basis of this approach, numerical buckling load data were obtained for simply supported curvilinearly corrugated plates covering a wide range of geometries. The results were compared with the predictions of orthotropic plate theory, and it was seen that the latter generally underestimates the buckling strength by a significant amount. Dissert. Abstr.

N78-32459 Washington Univ., Seattle.
A NUMERICAL-EXPERIMENTAL INVESTIGATION OF DYNAMIC FRACTURE Ph.D. Thesis
Shankar Mall 1977 229 p
Avail: Univ. Microfilms Order No. 7814467

Investigation of dynamic fracture were undertaken with the help of dynamic photoelasticity and numerical analysis. A dynamic finite element algorithm was developed for computing the dynamic stress intensity factors from the experimentally determined crack position versus time relation of a propagating and arresting crack. A successful application of the developed numerical procedure was demonstrated in the investigation of three phases of dynamic fracture, i.e., initiation, propagation and arrest. The dynamic response of dynamic tear test specimens was also investigated. Dissert. Abstr.

N78-32460 Carnegie-Mellon Univ., Pittsburgh, Pa.
AN ISOPARAMETRIC FORMULATED SPECIAL FINITE ELEMENT FOR THE ELASTO-PLASTIC ANALYSIS OF CRACKED BODIES Ph.D. Thesis
Carlos Marino 1978 212 p
Avail: Univ. Microfilms Order No. 78-14386

A special element in the context of a higher-order isoparametric formulation for the elasto-plastic analysis of bodies containing sharp cracks and other types of discontinuities is presented. Interelement compatibility between the special element and its host, the eight-noded isoparametric quadrilateral, is attained. For a given notch geometry and material stress-strain curve, at each load step the present model accommodates itself to the variation in the strength of the singularity, by treating the singularity as an extra degree of freedom in the incremental process. The concept is extended to the formulation of a higher-order family of singular elements based on a modified Pascal triangle. A set of elastic problems is solved to predetermine the optimum numerical integration scheme and number of special elements to permit an accurate evaluation of the crack tip stress and deformation fields for a general plane strain tensile loading situation. Dissert. Abstr.

N78-32461 Texas A&M Univ., College Station.
ELASTOSTATIC FIELDS IN A CRACK TIP NEIGHBORHOOD: MEASUREMENTS AND UNIQUENESS Ph.D. Thesis
Joseph Henry Schmidt 1978 119 p
Avail: Univ. Microfilms Order No. 7817215

Theoretical and experimental investigations of stress and displacement distributions in cracked solids are described. The effect of damaged material in the small highly stressed zone around a crack tip on maximum shear stress trajectories was first shown. Discussed next is experimental work consisting of tensile tests conducted with long rectangular strips of solid propellant clamped along the long edges and containing a central crack; displacements of the strip were obtained through speckle diffraction interferometry. These results are compared to predicted displacements using a finite element technique. Finally, a uniqueness theorem for weak elastostatic traction problems is proved; hypotheses in Kirchhoff's uniqueness theorem are relaxed, and uniqueness is proved for a variety of singular problems including the crack problem. Dissert. Abstr.

N78-32462# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
EFFECT OF AIRCRAFT LOADING PROGRAM MODIFICATIONS ON THE FATIGUE LIFE AND DAMAGE CUMULATION. PART 1: EFFECT OF LOAD PEAKS IN CASE OF CENTRAL HOLE SHEET SPECIMENS
Alfred Buch Jul. 1978 62 p refs
(TAE-334-Pt-1; ICAF-1040) Avail: NTIS HC A04/MF A01

Flight simulation and program tests were performed with different 2024-T3 sheet specimens containing a central hole. The effect of the peak-load frequency on the damage sum and flight number was investigated. For sufficiently close spectra with similar log-linear airborne stress distribution but different GAG cycle distribution, the relative Miner rule yielded satisfactory results. In the case of truncation levels the investigated change of the frequency of stress cycles at the highest loading level had a weak effect on the damage sum, while the effect of decrease of the frequency of the lowest stress amplitude was considerable in some cases. It was found that in particular loading program cases, rare load peaks may have not only a beneficial but also a detrimental effect on the number of simulated flights. Truncation had a detrimental effect, but the increase of the number of overload peaks above the number of cycles at the truncation level associated with the log-linear gust distribution had also a detrimental effect. L.S.

N78-32463*# Old Dominion Univ. Research Foundation, Norfolk, Va.
A COMPUTER GRAPHICS PROGRAM FOR GENERAL FINITE ELEMENT ANALYSES
Earl A. Thornton and Lynn M. Sawyer Aug. 1978 50 p refs (Grant NsG-1321)
(NASA-CR-157421) Avail: NTIS HC A03/MF A01 CSCL 20K

Documentation for a computer graphics program for displays from general finite element analyses is presented. A general description of display options and detailed user instructions are given. Several plots made in structural, thermal and fluid finite element analyses are included to illustrate program options. Sample data files are given to illustrate use of the program. Author

N78-32464*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IMPETUS OF COMPOSITE MECHANICS ON TEST METHODS FOR FIBER COMPOSITES

C. C. Chamis 1978 31 p refs Presented at the US-USSR Seminar on Fracture of Composite Mater., Riga, USSR, 4-7 Sep. 1978
(NASA-TM-78979; E-9734) Avail: NTIS HC A03/MF A01 CSCL 11D

The impetus of composite mechanics on composite test methods and/or on interpreting test results is described by using examples from composite micromechanics, composite macromechanics and laminate theory. The specific examples included contributions such as criteria for selecting resin matrices for improved composite strength, the 10 deg off-axis tensile test, criteria for configuring hybrids and superhybrids for improved impact resistance and the reduced bending rigidities concept for buckling and vibration analyses. G.G.

N78-32465*# California Univ., Los Angeles.
ACCESS-2: APPROXIMATION CONCEPTS CODE FOR EFFICIENT STRUCTURAL SYNTHESIS, USER'S GUIDE
Hirokazu Miura and Lucien A. Schmit, Jr. Sep. 1978 116 p refs
(Contract NGR-05-007-337)
(NASA-CR-158949) Avail: NTIS HC A06/MF A01 CSCL 20K

A user's guide is presented for the ACCESS-2 computer program. ACCESS-2 is a research oriented program which implements a collection of approximation concepts to achieve excellent efficiency in structural synthesis. The finite element method is used for structural analysis and general mathematical programming algorithms are applied in the design optimization procedure. G.G.

N78-32466*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SEVENTH NASTRAN USER'S COLLOQUIUM
Oct. 1978 499 p refs Colloquium held at Huntsville, Ala., 4-6 Oct. 1978
(NASA-CP-2062) Avail: NTIS HC A21/MF A01 CSCL 20K

The general application of finite element methodology and the specific application of NASTRAN to a wide variety of static and dynamic structural problems are described. Topics include: fluids and thermal applications, NASTRAN programming, substructuring methods, unique new applications, general auxiliary programs, specific applications, and new capabilities. For individual titles, see N78-32467 through N78-32491.

N78-32467*# Lockheed Electronics Co., Houston, Tex.
DYNAMIC STORAGE EXPANSION IN NASTRAN
Edwin N. Hess *In* NASA. Marshall Space Flight Center Seventh NASTRAN User's Colloq. Oct. 1978 p 1-11 refs (For primary document see N78-32466 23-39)
Avail: NTIS HC A21/MF A01 CSCL 20K

Some functions of NASTRAN require a large block of working computer storage to execute. The method of meeting this requirement, because of insufficient data, was to specify in advance an excessive amount of data to avoid a fatal exit. A method was developed to calculate the amount of working space needed for the analysis and to inform the analyst of this data or, in the case of Univac computers, to acquire this extra storage and continue the analysis. J.A.M.

N78-32468*# Computer Sciences Corp., Los Angeles, Calif.
NASTRAN COMPUTER RESOURCE MANAGEMENT FOR THE MATRIX DECOMPOSITION MODULES
Charles W. Bolz *In* NASA. Marshall Space Flight Center Seventh NASTRAN User's Colloq. Oct. 1978 p 13-23 refs (For primary document see N78-32466 23-39)
Avail: NTIS HC A21/MF A01 CSCL 20K

Detailed computer resource measurements of the NASTRAN matrix decomposition spill logic were made using a software input/output monitor. These measurements showed that, in general, job cost can be reduced by avoiding spill. The results indicated that job cost can be minimized by using dynamic memory management. A prototype memory management system is being implemented and evaluated for the CDC Cyber computer. J.A.M.

N78-32469*# IBM Japan.
ADDING STRESS PLOT FUNCTION TO NASTRAN
Shunichi Katoh *In* NASA. Marshall Space Flight Center Seventh NASTRAN User's Colloq. Oct. 1978 p 25-31 refs (For primary document see N78-32466 23-39)
Avail: NTIS HC A21/MF A01 CSCL 20K

Stress plot function was developed and added to the NASTRAN level 15.5. Computed stress distribution can be displayed by this function, with vectors showing the principal stresses of the finite elements over the specified portions of the structure. NASTRAN is reviewed in the aspect of plotting capabilities. Stress tensor field is examined in preparation of stress display. Then the stress plot function as added to the NASTRAN is described. A sample plotout by this function is shown. Author

N78-32470*# Tennessee Eastman Corp., Kingsport.
TYPICAL USES OF NASTRAN IN A PETROCHEMICAL INDUSTRY
J. Ronald Winter *In* NASA. Marshall Space Flight Center Seventh NASTRAN User's Colloq. Oct. 1978 p 33-65 (For primary document see N78-32466 23-39)
Avail: NTIS HC A21/MF A01 CSCL 20K

NASTRAN was principally used to perform failure analysis and redesign process equipment. It was also employed in the evaluation of vendor designs and proposed design modifications to existing process equipment. Stress analysis of forced draft fans, distillation trays, metal stacks, jacketed pipes, heat exchangers, large centrifugal fans, and agitator support structures are described. J.A.M.

N78-32471*# Missouri Univ. -Rolla.
USE OF NASTRAN IN A UNIVERSITY ENVIRONMENT
Chuh Mei *In* NASA. Marshall Space Flight Center Seventh NASTRAN User's Colloq. Oct. 1978 p 67-70 refs (For primary document see N78-32466 23-39)
Avail: NTIS HC A21/MF A01 CSCL 20K

A survey was conducted in the middle of the 1977-78 school year. Each faculty member of the civil engineering, engineering mechanics, and mechanical and aerospace engineering departments was asked to give information on the present (Level 15.5) and future projected (Level 17) usage of NASTRAN programs. Results from the survey study are summarized. J.A.M.

N78-32472*# Northrop Corp., Beverly Hills, Calif.
NASTRAN FINITE ELEMENT ANALYSIS ACTIVITY AT NORTHROP
Sveinn Thordarson *In* NASA. Marshall Space Flight Center Seventh NASTRAN User's Colloq. Oct. 1978 p 71-83 (For primary document see N78-32466 23-39)
Avail: NTIS HC A21/MF A01 CSCL 20K

In-house evaluation of the various analytical capabilities of the MSC version of NASTRAN, prior to production release, is a continuous effort. The NASTRAN superelement and subsonic aero features are presently being tested and brought on-line for production use. Two examples of recent NASTRAN structural solutions are also presented. J.A.M.

N78-32473*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DEVELOPMENT OF STRUCTURAL DYNAMIC TEST ENVIRONMENTS FOR SUBSYSTEMS AND COMPONENTS
Robert J. Coladonato *In* NASA. Marshall Space Flight Center Seventh NASTRAN User's Colloq. Oct. 1978 p 85-110 refs (For primary document see N78-32466 23-39)
Avail: NTIS HC A21/MF A01 CSCL 20K

Structural dynamic environmental test levels were developed for the thematic mapper instrument, components of the Tandberg-Hanssen instrument, and components of the International Ultraviolet Explorer spacecraft using NASTRAN structural models and test data. Both static and dynamic NASTRAN analyses were used. The model size required could be as small as 300 degrees of freedom for the static analysis and as large as 4000 degrees of freedom or more for the high frequency dynamic analysis. An important step in the development of the levels is model verification by test. The launch environments that generally dictate many important features of the design of an instrument

or component are steady state acceleration, sinusoidal vibration, and random vibration. J.A.M.

N78-32474*# Naval Ship Research and Development Center, Annapolis, Md.

REDUCTION OF MATRIX WAVEFRONT FOR NASTRAN

Gordon C. Everstine *In* NASA. Marshall Space Flight Center Seventh NASTRAN User's Colloq. Oct. 1978 p 111-121 refs (For primary document see N78-32466 23-39)

Avail: NTIS HC A21/MF A01 CSCL 20K

The three grid point resequencing algorithms most often run by NASTRAN users are compared for their ability to reduce matrix root-mean-square (rms) wavefront, which is the most critical parameter in determining matrix decomposition time in NASTRAN. The three algorithms are Cuthill-McKee (CM), Gibbs-Poole-Stockmeyer (GPS), and Levy. The first two (CM and GPS) are in the BANDIT program, and the Levy algorithm is in WAVEFRONT. Results are presented for a diversified collection of 30 test problems ranging in size from 59 to 2680 nodes. It is concluded that GPS is exceptionally fast and, for the conditions under which the test was made, the algorithm best able to reduce rms wavefront consistently well. J.A.M.

N78-32475*# International Business Machines Corp., Essex Junction, Vt. General Technology Div.

PRE AND POST PROCESSING USING THE IBM 3277 DISPLAY STATION GRAPHICS ATTACHMENT (RPQ7H0284)

S. H. Burroughs, M. B. Lawlor, and I. M. Miller *In* NASA. Marshall Space Flight Center Seventh NASTRAN User's Colloq. Oct. 1978 p 123-130 (For primary document see N78-32466 23-39)

Avail: NTIS HC A21/MF A01 CSCL 20K

A graphical interactive procedure operating under TSO and utilizing two CRT display terminals is shown to be an effective means of accomplishing mesh generation, establishing boundary conditions, and reviewing graphic output for finite element analysis activity. J.A.M.

N78-32476*# Hitachi, Ltd., Tokyo (Japan).

IG/OG PROGRAM FOR GENERATING AND DISPLAYING NASTRAN INPUT AND OUTPUT DATA

Ryoichi Mishima and Akinori Myojin *In* NASA. Marshall Space Flight Center Seventh NASTRAN User's Colloq. Oct. 1978 p 131-145 (For primary document see N78-32466 23-39)

Avail: NTIS HC A21/MF A01 CSCL 20K

A software system was provided for structural analysis fields using NASTRAN. The HITAC users in Japan can use IG/OG (input generator/output generator) program for NASTRAN. The IG/OG saves time required to make a structure analysis for interpreting NASTRAN results. J.A.M.

N78-32477*# Exxon Production Research Company, Houston, Tex.

NASTRAN IMPLEMENTATION OF AN ISOPARAMETRIC DOUBLY-CURVED QUADRILATERAL SHELL ELEMENT

A. B. Potvin and R. D. Leick *In* NASA. Marshall Space Flight Center Seventh NASTRAN User's Colloq. Oct. 1978 p 147-191 refs (For primary document see N78-32466 23-39)

Avail: NTIS HC A21/MF A01 CSCL 20K

A quadrilateral shell element, CQUAD4, was added to level 15.5 and subsequently to level 16.0 of NASTRAN. The element exhibited doubly curved surfaces and used biquadratic interpolation functions. Reduced integration techniques were used to improve the performance of the element in thin shell problems. The creation of several new bulk data items is discussed, along with a special module, GPNORM, to process SHLNORM bulk data cards. In addition to the theoretical basis for the element stiffness matrix, consistent mass and load matrices are presented. Several potential sources of degenerate behavior of the element were investigated. Guidelines for proper use of the element were suggested. Performance of the element on several widely published classical examples was demonstrated. The results showed a significant improvement over presently available NASTRAN shell elements for even the coarsest meshes. Potential applications to two classes of practical problems are discussed. J.A.M.

N78-32478*# Naval Underwater Systems Center, New London, Conn.

MODELING STRUCTURAL DAMPING FOR SOLIDS HAVING DISTINCT SHEAR AND DILATATIONAL LOSS FACTORS

A. J. Kalinowski *In* NASA. Marshall Space Flight Center Seventh NASTRAN User's Colloq. Oct. 1978 p 193-205 refs (For primary document see N78-32466 23-39)

Avail: NTIS HC A21/MF A01 CSCL 20K

For steady state time harmonic problems (rigid format 8), the NASTRAN program as currently configured treats internal structural damping through the introduction of a single structural element damping coefficient that typically is viewed as the ratio of the complex to real modulus of elasticity. For problems dealing with two or three dimensional dynamic linear viscoelasticity (e.g. a Kelvin-Voigt viscoelastic model), the present NASTRAN capability cannot directly handle this situation wherein two independent damping coefficients are required to properly model the dissipation phenomenon. A technique is presented whereby the user can adapt the standard versions of NASTRAN (without resorting to either DMAP and/or FORTRAN coding changes) for the purpose of treating this class of problem. J.A.M.

N78-32479*# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio. Structural Mechanics Div.

THERMAL STRESS ANALYSIS OF CERAMIC STRUCTURES WITH NASTRAN ISOPARAMETRIC SOLID ELEMENTS

Steven E. Lamberson and Donald B. Paul *In* NASA. Marshall Space Flight Center Seventh NASTRAN User's Colloq. Oct. 1978 p 207-215 (For primary document see N78-32466 23-39)

Avail: NTIS HC A21/MF A01 CSCL 20K

The performance of the NASTRAN level 16.0, twenty node, isoparametric bricks (CIHEX2) at thermal loading was studied. A free ceramic plate was modelled using twenty node bricks of varying thicknesses. The thermal loading for this problem was uniform over the surface with an extremely large gradient through the thickness. No mechanical loading was considered. Temperature-dependent mechanical properties were considered in this analysis. The NASTRAN results were compared to one dimensional stress distributions calculated by direct numerical integration. J.A.M.

N78-32480*# International Business Machines Corp., Armonk, N.Y.

A SIMPLE ELEMENT FOR MULTILAYER BEAMS IN NASTRAN THERMAL STRESS ANALYSIS

W. T. Chen and S. K. Wadhwa *In* NASA. Marshall Space Flight Center Seventh NASTRAN User's Colloq. Oct. 1978 p 217-223 ref (For primary document see N78-32466 23-39)

Avail: NTIS HC A21/MF A01 CSCL 20K

In the application of NASTRAN, structural members are usually represented by bar elements with multipoint constraint cards to enforce the interface conditions. While this is a very powerful method in principle, it was found that in practice the process for specification of constraints became tedious and error prone, unless the geometry was simple and the number of grid points low. An alternative approach was found within the framework of the NASTRAN program. This approach made use of the idea that a thermal distortion in a multilayer beam may be similar to a homogeneous beam with a thermal gradient across the cross section. The exact mathematical derivation for the equivalent beam, and all the necessary formulae for the equivalent parameters in NASTRAN analysis are presented. Some numerical examples illustrate the simplicity and ease of this approach for finite element analysis. J.A.M.

N78-32481*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ALIGNMENT DISPLACEMENTS OF THE SOLAR OPTICAL TELESCOPE PRIMARY MIRROR

Walter V. Medenica *In* NASA. Marshall Space Flight Center Seventh NASTRAN User's Colloq. Oct. 1978 p 225-245 refs (For primary document see N78-32466 23-39)

Avail: NTIS HC A21/MF A01 CSCL 20K

Solar optical telescope is a space shuttle payload which is at the present time (1978) being planned. The selected alignment method for the telescope's primary mirror is such that the six inclined legs supporting the mirror are at the same time motorized alignment actuators, changing their own length according to the

alignment requirement and command. The alignment displacements were described, including circumvention of some apparent NASTRAN limitations. J.A.M.

N78-32482*# Ebasco Services, Inc., New York.
APPLICATION OF NASTRAN TO TFTR TOROIDAL FIELD COIL STRUCTURES
S. J. Chen and E. Lee (Grumman Aerospace Corp., Bethpage, N.Y.) *In* NASA. Marshall Space Flight Center Seventh NASTRAN User's Colloq. Oct. 1978 p 247-278 refs Prepared for Princeton Univ. (For primary document see N78-32466 23-39) (Contract EY-76-C-02-3093)
Avail: NTIS HC A21/MF A01 CSCL 20K

The primary applied loads on the TF coils were electromagnetic and thermal. The complex structure and the tremendous applied loads necessitated computer type of solutions for the design problems. In the early stage of the TF coil design, many simplified finite element models were developed for the purpose of investigating the effects of material properties, supporting schemes, and coil case material on the stress levels in the case and in the copper coil. In the more sophisticated models that followed the parametric and scoping studies, the isoparametric elements, such as QUAD4, HEX8, and HEXA, were used. The analysis results from using these finite element models and the NASTRAN system were considered accurate enough to provide timely design information. J.A.M.

N78-32483*# Goodrich (B. F.) Co., Akron, Ohio.
STATIC ANALYSIS OF A SONAR DOME RUBBER WINDOW
J. L. Lai *In* NASA. Marshall Space Flight Center Seventh NASTRAN User's Colloq. Oct. 1978 p 279-290 refs (For primary document see N78-32466 23-39)
Avail: NTIS HC A21/MF A01 CSCL 20K

The application of NASTRAN (level 16.0.1) to the static analysis of a sonar dome rubber window (SDRW) was demonstrated. The assessment of the conventional model (neglecting the enclosed fluid) for the stress analysis of the SDRW was made by comparing its results to those based on a sophisticated model (including the enclosed fluid). The fluid was modeled with isoparametric linear hexahedron elements with approximate material properties whose shear modulus was much smaller than its bulk modulus. The effect of the chosen material property for the fluid is discussed. J.A.M.

N78-32484*# Naval Ship Research and Development Center, Annapolis, Md.
SOLVING MAGNETOSTATIC FIELD PROBLEMS WITH NASTRAN
Myles M. Hurwitz and Erwin A. Schroeder *In* NASA. Marshall Space Flight Center Seventh NASTRAN User's Colloq. Oct. 1978 p 291-299 refs (For primary document see N78-32466 23-39)
Avail: NTIS HC A21/MF A01 CSCL 20K

Determining the three-dimensional magnetostatic field in current-induced situations has usually involved vector potentials, which can lead to excessive computational times. How such magnetic fields may be determined using scalar potentials is reviewed. It is shown how the heat transfer capability of NASTRAN level 17 was modified to take advantage of the new method. J.A.M.

N78-32485*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TRANSIENTS BY SUBSTRUCTURING WITH DMAP
Thomas G. Butler (Butler Analyses) *In its* Seventh NASTRAN User's Colloq. Oct. 1978 p 301-333 (For primary document see N78-32466 23-39)
Avail: NTIS HC A21/MF A01 CSCL 20K

Automated substructuring in level 16 of NASTRAN was employed as a preface to the solution of a direct transient analysis. The DMAP ALTER statements written to adapt the substructuring for transient purposes are explained. Data recovery was accomplished with transfer functions. Proof of the success of the method is presented with an application to a missile structure. J.A.M.

N78-32486*# Hughes Helicopters, Culver City, Calif.
DYNAMIC ANALYSIS USING SUPERELEMENTS FOR A LARGE HELICOPTER MODEL
Magan P. Patel and Lalit C. Shah (Multiple Access Inc.) *In* NASA. Marshall Space Flight Center Seventh NASTRAN User's Colloq. Oct. 1978 p 335-354 (For primary document see N78-32466 23-39)
Avail: NTIS HC A21/MF A01 CSCL 20K

Using superelements (substructures), modal and frequency response analysis was performed for a large model of the Advanced Attack Helicopter developed for the U.S. Army. Whiffletree concept was employed so that the residual structure along with the various superelements could be represented as beam-like structures for economical and accurate dynamic analysis. A very large DMAP alter to the rigid format was developed so that the modal analysis, the frequency response, and the strain energy in each component could be computed in the same run. J.A.M.

N78-32487*# Northrop Corp., Beverly Hills, Calif.
COMPARISON OF SEVERAL NASTRAN ANALYTICAL TECHNIQUES FOR LARGE STRUCTURES
David T. Zemer *In* NASA. Marshall Space Flight Center Seventh NASTRAN User's Colloq. Oct. 1978 p 355-363 refs (For primary document see N78-32466 23-39)
Avail: NTIS HC A21/MF A01 CSCL 20K

In order to plan for the finite element structural analysis of future aircraft, five static analysis techniques using the MacNeal--Schwendler Corporation version of NASTRAN were evaluated. The structure was analyzed as: (1) a single model with a symmetric loading condition; (2) a single model with symmetric/nonsymmetric loading conditions; (3) three substructures in three phases using tape storage with a symmetric loading condition; (4) three superelements using data base storage with a symmetric loading condition; and (5) three superelements using data base storage with cyclic symmetry for symmetric/nonsymmetric loading conditions. The superelement techniques proved superior to the single model approaches by reducing computer time for redesign work by as much as 70 percent. J.A.M.

N78-32488*# Grumman Aerospace Corp., Bethpage, N.Y.
A NASTRAN ANALYSIS OF A TOKAMAK VACUUM VESSEL USING INTERACTIVE GRAPHICS
Arthur Miller and Morris Badrian (Ebasco Services, Inc.) *In* NASA. Marshall Space Flight Center Seventh NASTRAN User's Colloq. Oct. 1978 p 365-388 refs (For primary document see N78-32466 23-39)
Avail: NTIS HC A21/MF A01 CSCL 20K

Isoparametric quadrilateral and triangular elements were used to represent the vacuum vessel shell structure. For toroidally symmetric loadings, MPCs were employed across model boundaries and rigid format 24 was invoked. Nonsymmetric loadings required the use of the cyclic symmetry analysis available with rigid format 49. NASTRAN served as an important analysis tool in the Tokamak design effort by providing a reliable means for assessing structural integrity. Interactive graphics were employed in the finite element model generation and in the post-processing of results. It was felt that model generation and checkout with interactive graphics reduced the modelling effort and debugging man-hours significantly. J.A.M.

N78-32489*# Universal Analytics, Inc., Los Angeles, Calif.
ACCURACY OF RESULTS WITH NASTRAN MODAL SYNTHESIS
D. N. Herting *In* NASA. Marshall Space Flight Center Seventh NASTRAN User's Colloq. Oct. 1978 p 389-404 refs (For primary document see N78-32466 23-39)
Avail: NTIS HC A21/MF A01 CSCL 20K

A new method for component mode synthesis was developed for installation in NASTRAN level 17.5. Results obtained from the new method are presented, and these results are compared with existing modal synthesis methods. J.A.M.

N78-32490*# Computer Sciences Corp., Los Angeles, Calif.
ON THE APPEND AND CONTINUE FEATURES IN NASTRAN
P. R. Pamidi *In* NASA. Marshall Space Flight Center Seventh NASTRAN User's Colloq. Oct. 1978 p 405-417 refs (For

primary document see N78-32466 23-39)
Avail: NTIS HC A21/MF A01 CSCL 20K

The APPEND feature is described which is applicable in the case of real eigenvalue analysis. This feature permitted the addition of new eigenvalues and eigenvectors to those already computed in a previously checkpointed run without re-executing the entire problem. The next feature was the CONTINUE feature which was applicable in the case of transient analysis of coupled equations. This feature enabled the integration of coupled equations to be continued beyond the last output time for which the solution was obtained in a previously checkpointed run (without re-executing the entire problem). These two features are illustrated by suitable examples. J.A.M.

N78-32491*# Business and Technological Systems, Inc., Bowie, Md.

EXTENSION OF THE TRIDIAGONAL REDUCTION (FEER) METHOD FOR COMPLEX EIGENVALUE PROBLEMS IN NASTRAN

Malcolm Newman (Inter-City Testing and Consulting Corp.) and Frederick I. Mann *In* NASA. Marshall Space Flight Center Seventh NASTRAN User's Colloq. Oct. 1978 p 419-446 refs
(For primary document see N78-32466 23-39)
Avail: NTIS HC A21/MF A01 CSCL 20K

As in the case of real eigenvalue analysis, the eigensolutions closest to a selected point in the eigenspectrum were extracted from a reduced, symmetric, tridiagonal eigenmatrix whose order was much lower than that of the full size problem. The reduction process was effected automatically, and thus avoided the arbitrary lumping of masses and other physical quantities at selected grid points. The statement of the algebraic eigenvalue problem admitted mass, damping, and stiffness matrices which were unrestricted in character, i.e., they might be real, symmetric or nonsymmetric, singular or nonsingular. J.A.M.

N78-32492*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

BUCKLING AND STRUCTURAL EFFICIENCY OF SANDWICH-BLADE STIFFENED COMPOSITE COMPRESSION PANELS

Manuel Stein and Jerry G. Williams Sep. 1978 40 p refs
(NASA-TP-1269; L-12242) Avail: NTIS HC A03/MF A01 CSCL 20K

The minimum mass structural efficiency curve was determined for sandwich blade stiffened composite compression panels subjected to buckling and strength constraints. High structural efficiencies are attainable for this type of construction. A method of analysis is presented for the buckling of panels of this configuration which shows that buckling of such panels is strongly dependent on the through-the-thickness transverse shearing of the stiffener. Experimental results are presented and compared with theory. Author

N78-32493# National Mechanical Engineering Research Inst., Pretoria (South Africa). Strength Mechanics Div.

ACCUMULATION OF FATIGUE DAMAGE UNDER RANDOM LOADING CONDITIONS

J. T. D. Fritz Dec. 1977 46 p refs
(CSIR-ME-1542) Avail: NTIS HC A03/MF A01

Some aspects of accumulation of fatigue damage under random loading conditions are presented and discrepancies between the linear cumulative damage law and actual in-service results are pointed out. Procedures for describing random loading spectra with descriptive parameters and counting methods are outlined and the possibility of utilizing the linear cumulative damage rule in conjunction with fatigue curves obtained with random loading spectra are presented and discussed. G.Y.

N78-32494# National Mechanical Engineering Research Inst., Pretoria (South Africa). Aeronautics Research Unit.

FINITE ELEMENT SOLUTION OF TORSIONAL STIFFNESS AND SHEAR CENTRE FOR SECTIONS OF ARBITRARY SHAPE AND COMPOSITION

E. M. E. Baumgartner Nov. 1977 51 p refs
(CSIR-ME-1540) Avail: NTIS HC A04/MF A01

A computer program which theoretically predicts the shear center of inhomogeneous arbitrarily shaped sections is presented. G.Y.

N78-32495# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.

THE MEASUREMENT OF CRACK TIP STRESSES BY X-RAY DIFFRACTION Final Report, Jun. 1976 - Dec. 1977

John E. Allison Mar. 1978 135 p refs
(AD-A055216; AFFDL-TR-78-24) Avail: NTIS HC A07/MF A01 CSCL 11/6

To ensure the structural integrity of present day structures subjected to variable amplitude cyclic stress histories, a knowledge of the crack tip stress field is important. In this investigation, crack tip stresses were measured in specimens of 1020 and 1045 steel using a semi-automatic X-ray diffraction technique. Crack tip residual stresses were measured in the unloaded condition and crack tip 'applied' stresses were measured under load. It was observed that, for the alloys tested and within the confines of stress analysis by X-ray diffraction, a dependence exists for the maximum crack tip residual stress on the level of the previous stress intensity factor and also for the maximum crack tip 'applied' stress on the level of the applied stress intensity. This is in sharp contrast to theoretical models of the crack tip stress fields which predict an independence between crack tip stresses and stress intensity levels. Crack tip stresses were observed relative to the fatigue crack growth retardation process. Post overload crack tip stresses were greatly reduced from their pre-overload levels. Limited studies indicated that crack growth, after an overload, had little or no effect on the overload-induced crack tip residual stress distribution. Measurements taken at applied loads, indicated that portions of the material behind the tip of the extended crack were in compression while areas ahead of the extended crack were in tension. These results were considered in light of possible retardation mechanisms. GRA

N78-32496# Air Force Materials Lab., Wright-Patterson AFB, Ohio.

THE INFLUENCE OF HOLE PROCESSING AND JOINT VARIABLES ON THE FATIGUE LIFE OF SHEAR JOINTS, VOLUME 1 Final Report, May 1975 - May 1977

Thomas K. Moore Feb. 1978 236 p refs
(AD-A054770; AFML-TR-77-167-Vol-1) Avail: NTIS HC A11/MF A01 CSCL 13/5

Four hundred eighty fatigue test specimens were cycled in constant amplitude fatigue, using four designs, zero, 5, 50, and 100% load transfer, with two fasteners installed, and processing conditions such as hole diameter and angle, surface roughness, fastener preload, faying surface fretting protection, and hole cold-work, individually varied. The data was collected in computer files, and multiple stepwise regression analysis performed with specimen life as the dependent variable. A family of 15 models for predicting variation in fatigue lives was developed. Factors most effective were determined. Hole surface roughness was found generally either not to enter into the predictive equations, or to enter very weakly into the model. When hole roughness entered the models, its effects were almost equally divided between increasing roughness showing increases or decreases in fatigue life. Fastener interference was determined to be a key parameter in determining fatigue life. Interference was approximately twice as effective as hole cold-working in fatigue life enhancement. GRA

N78-32497# Army Armament Research and Development Command, Watervliet, N. Y. Benet Weapons Lab.

COLLAPSED 12-NODE TRIANGULAR ELEMENTS AS CRACK TIP ELEMENTS FOR ELASTIC FRACTURE

S. L. Pu, M. A. Hussain, and W. E. Lorensen Dec. 1977 55 p refs
(AD-A055930; AD-E440011; ARLCB-TR-77047) Avail: NTIS HC A04/MF A01 CSCL 20/11

For the 12-node bicubic, quadrilateral, isoparametric elements, it is shown that the inverse square root singularity of the strain field at the crack tip can be obtained by the simple technique of collapsing the quadrilateral element into triangular elements around the crack tip and placing the two mid-side nodes of each side of the triangles at 1/9 and 4/9 of the length of the side from the tip. This is analogous to placing the mid-side nodes at quarter points in the vicinity of the crack tip for the quadratic, isoparametric element. The advantages of this method are that the displacement compatibility is satisfied throughout the region and that there is no need of special crack tip elements.

The stress intensity factors can be accurately obtained by using general purpose programs having isoparametric elements such as NASTRAN. The use of 12-node isoparametric element program APES may be simplified by eliminating the special crack tip elements. Author (GRA)

N78-32498# Naval Civil Engineering Lab., Port Hueneme, Calif.
OPTIMUM DYNAMIC DESIGN OF NONLINEAR PLATES UNDER BLAST LOADING Technical Note, Oct. 1977 - Feb. 1978
J. M. Ferritto Mar. 1978 58 p refs
(AD-A055601; CEL-TN-1518) Avail: NTIS HC A04/MF A01 CSCL 19/4

A computer program was developed to determine the approximate nonlinear dynamic response of plates subjected to blast pressure loading. Given the explosive parameters and geometry of the plate, the program computes the blast environment and the structural resistance, mass, and stiffness of the plate and solves for the dynamic response. The program contains optimization subroutines that provide for automatic optimum design of least-cost plates. The program will assist engineers in the design and analysis of blast doors that are intended to contain the effects of accidental explosions. The report gives a user's guide and sample problems with data input and program output. Author (GRA)

N78-32499# Physics International Co., San Leandro, Calif.
THERMOSTRUCTURAL RESPONSE OF ALUMINUM ANNULI Final Report, Mar. 1976 - Sep. 1977
E. V. Buck and James Shea Mar. 1978 301 p refs
(Contract DNA001-76-C-0246)
(AD-A055967; AD-E300233; PIFR-930-2; DNA-4480F) Avail: NTIS HC A14/MF A01 CSCL 13/13

The thermostructural response of aluminum annuli subjected to sudden radiation heating was experimentally investigated using pulsed electron beams. The DNA OWL II generator, operating at a nominal mean voltage of 1.0 MeV, provided the radiation environment. Transport of the electron beam from the diode to the target was achieved using a longitudinal magnetic field. The annuli were irradiated uniformly on one side. Circumferential strain data were obtained on the outer diameter of the annuli at two locations 90 degrees apart. Problems with strain gauge survivability were encountered and a new strain gauge design was developed especially for these experiments. Quartz gauge stresstime measurements were performed on flat aluminum specimens simultaneously with the annulus experiments. The response was also observed with fast motion pictures (7000 frames/sec). Data were obtained at fluences that varied between 3 cal/sq.cm (elastic response) and 15 cal/sq.cm (elastic-plastic response). GRA

N78-32500# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
SUMMARY OF RESEARCH ON LINEAR AND NONLINEAR EFFECTS ON VIBRATION OF ELASTIC STRUCTURES Final Scientific Report, 1 Jan. 1973 - 31 Dec. 1977
Lawrence W. Rehfield May 1978 25 p refs
(Grant AF-AFOSR-2479-73)
(AD-A055949; AFOSR-78-1097TR) Avail: NTIS HC A02/MF A01 CSCL 20/1

This report contains a brief summary of research on linear and nonlinear effects in the vibration of elastic structures. The research includes studies of nonlinear vibration of structures, boundary restraint effects in vibration and hygrothermal effects on dynamic behavior of resin matrix composites. A listing of reports and publications that have resulted from this activity is included. GRA

N78-32501# Oakland Univ., Rochester, Mich. School of Engineering.
NEW OPTICAL METHOD TO DETERMINE VIBRATION-INDUCED STRAINS WITH VARIABLE SENSITIVITY AFTER RECORDING
J. D. Hovanesian and Y. Y. Hung May 1978 24 p refs
(Contract N00014-76-C-0487; Grant NSF ENG-77-07974; OU Proj. 31414-24; OU Proj. 32110-18)
(AD-A055390; Rept-47) Avail: NTIS HC A02/MF A01 CSCL 20/6

A steady-state vibrating object is illuminated with coherent light and its image is slightly misfocused in the film plane of a camera. The resulting processed film is called a time-integrated specklegram. When the specklegram is Fourier filtered, it exhibits fringes depicting derivatives of the vibrational amplitude. The direction of the spatial derivative, as well as the fringe sensitivity may be easily and continuously varied during the Fourier filtering process. Besides the above mentioned advantages, this new method is also much less demanding than holographic interferometry with respect to vibration isolation, optical set-up time, illuminating source coherence, required film resolution, etc. Author (GRA)

N78-32502# Pennsylvania Univ., Philadelphia. Dept. of Metallurgy and Materials Science.
THE CYCLIC STRESS-STRAIN RESPONSE OF HIGH STRENGTH ALUMINUM ALLOYS AND ITS RELATION TO FRACTURE Final Report, 1 Apr. 1975 - 31 Mar. 1978
Campbell Laird 1 May 1978 16 p refs
(Grants DAAG29-77-G-0120; DAAG29-75-G-0129)
(AD-A055433; ARO-12456.10-MS) Avail: NTIS HC A02/MF A01 CSCL 11/6

Cyclic stress-strain response has been studied in copper, variously treated Al-15% Ag alloy, and several variants of 7075 aluminum alloy with different amounts of minor constituents, with the aim of investigating the role of microstructure in such response. Emphasis has been placed on mechanisms of rapid hardening and saturation, on the distribution of slip as controlled by the microstructure and on the relation between the cyclic deformation mechanisms and the fatigue damage mechanisms. Author (GRA)

N78-32503# Wisconsin Univ. - Madison. Dept. of Engineering Mechanics.
PROBABILISTIC FACTORS IN RANDOM FATIGUE
T. C. Huang, K. S. Shen, and Vinod K. Nagpal Oct. 1977 20 p refs
(Contract N00014-76-C-0825)
(AD-A055626; UW/RF-1) Avail: NTIS HC A02/MF A01 CSCL 20/11

To predict random fatigue life, the popular cumulative damage criterion, which is based on constant amplitude sinusoidal fatigue tests, is known to be inaccurate. Therefore, actual random fatigue experiments are proposed to establish new and reliable damage criterion. In this report, all conceivable probabilistic factors which affect random fatigue life are explored and mathematically analyzed. Based on these factors the random fatigue experiments will be planned and conducted.
Author (GRA)

N78-32504# Lockheed-California Co., Burbank.
FLAW GROWTH IN COMPLEX STRUCTURE. VOLUME 3: SUMMARY, ASSESSMENTS, CONCLUSIONS Final Report, 12 May 1975 - 12 Sep. 1977
T. R. Brussat, S. I. Chiu, and M. Creager Dec. 1977 67 p refs
(Contract F33615-75-C-3093)
(AD-A055483; LR-28272-Vol-3; AFFDL-TR-77-79-Vol-3) Avail: NTIS HC A04/MF A01 CSCL 01/3

Fatigue crack growth testing and analysis was conducted to evaluate the effects of initial flaw location and multiplicity on fatigue crack growth life and element failure sequence in multiple element, mechanically fastened metallic structure. The test program, including 68 precracked structural specimens consisting of 26 joints and 42 stringer-reinforced panels, is summarized. The test results and corresponding analytical results are presented and compared. With respect to the test results for precracked joints the following effects are discussed: fastener torque, faying surface friction, friction under the fastener head, single and multiple initial flaws, fretting, transverse bending, flush-head and protruding-head fasteners, and spectrum loading effects. With respect to the results for precracked stringer reinforced panels the following are discussed: longitudinal splice versus continuous skin, initial flaw locations, single or multiple initial flaws, presence of continuing damage flaws, crack growth in a tee or angle stringer, transverse bending, load shedding effects, spectrum loading, fracture surface marking, stress level, and crack path.

Guidelines and recommendations based on the results from this program are discussed. Author (GRA)

N78-32505# Lehigh Univ., Bethlehem, Pa. Inst. of Fracture and Solid Mechanics.
ON UNDERSTANDING ENVIRONMENT ENHANCED FATIGUE GROWTH: A PERSPECTIVE VIEW (1968-1977)
R. P. Wei May 1978 34 p refs Presented at the ASTM Symp. on Fatigue Mech., Kansas City, Mo., 22-23 May 1978
(Contract N00014-75-C-0543; NR Proj. 036-097)
(AD-A055497; IFSM-78-90; TR-7) Avail: NTIS HC A03/MF A01 CSCL 11/6

Corrosion fatigue (CF) is a generic term that is used to describe the phenomenon of cracking (including environment enhanced fatigue crack growth) in materials under the conjoint actions of an applied cyclic stress and a corrosive (aggressive) environment. It has been recognized as an important cause for failure of engineering structures. Characterization and understanding of corrosion fatigue are essential to service life prediction, fracture control, and the development of fatigue resistant alloys. Quantitative characterization and understanding have been hampered by the complexity of the problem, difficulties in separating the effects associated with crack initiation and with crack growth, and the absence of truly interdisciplinary attack of this problem. GRA

N78-32506# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
EFFECTS OF PREBUCKLING DISPLACEMENTS ON STRINGER STIFFENED AXIALLY LOADED CYLINDRICAL PANELS M.S. Thesis
Mark F. Mulholland Mar. 1978 79 p refs
(AD-A055836; AFIT/GAE/AA/78M-9) Avail: NTIS HC A05/MF A01 CSCL 20/11

The effects of straight-edge boundary conditions, stringer eccentricity, and prebuckling effects are studied for a wide variety of cylindrical shell panels under axial compression. Two prebuckling boundary conditions were used along the straight edges: CC3 and CC1 for clamped panels, and SS3 and SS1 for simply supported panels. Four buckling boundary conditions are considered for the clamped panels and four buckling boundary conditions are considered for the simply supported panels. The panels were stiffened with both internal and external arbitrary smeared stringers. The study was made using the STAGS computer code, utilizing the linear bifurcation branch with linear prebuckling displacements and smeared stringers. Results are presented that compare the buckling loads for different prebuckling boundary conditions, compare the effects of eccentricity, and compare the effects of prebuckling with comparison made to panel buckling loads without prebuckling displacements. GRA

N78-32507# California Univ., Berkeley. Lawrence Berkeley Lab.
DEFORMATION OF SUPERPLASTIC ALLOYS AT RELATIVELY LOW STRAIN RATES
D. Grivas Feb. 1978 96 p refs
(Contract W-7405-eng-48)
(LBL-7375) Avail: NTIS HC A05/MF A01

The superplastic and sub-superplastic creep properties of Pb-Sn eutectic and Al-Zn eutectoid alloys were studied. Various thermomechanical treatments were tested to check the possibilities of whether the subsuperplastic deformation mechanism is affected by these treatments. All thermomechanical histories were found to reveal the same stress exponent, which is believed to be indicative of the predominant mechanism. The mechanical data in the low stress region led to the suggestion that dislocation glide is the predominant mechanism in this region. At higher stresses extensive grain boundary sliding takes place and the dislocation movement is directed to relieve the stress concentration developed by the grain movement. ERA

N78-32508# Sandia Labs., Albuquerque, N. Mex.
ELASTIC-PLASTIC RESPONSE OF 304 STAINLESS STEEL BEAMS TO IMPULSE LOADS
M. J. Forrestal and M. J. Sagartz Jan. 1978 22 p refs
(Contract EY-76-C-04-0789)
(SAND-77-2101) Avail: NTIS HC A02/MF A01

The elastic-plastic response of 304 stainless steel beams was examined experimentally and analytically. Simply supported beams were loaded with half-sine distributed, short-duration magnetic pressure pulses and the response was monitored with a streak camera and strain gages. An approximate theory for peak deflection which includes strain rate effects and hardening is developed. ERA

N78-32509# California Univ., Livermore. Lawrence Livermore Lab.
FATIGUE CRACK INITIATION AND PROPAGATION IN STEELS EXPOSED TO INERT AND CORROSIVE ENVIRONMENTS Final Report, 1 May. - 31 Dec. 1977
K. Youseffi and I. Finnie Feb. 1978 196 p refs
(Contract W-7405-eng-48)
(UCRL-13825) Avail: NTIS HC A09/MF A01

The fatigue crack initiation life of AISI 1018 steel was investigated using compact tension specimens having sharp notch root radii. The data were analyzed using two methods of predicting initiation in strain cycling experiments. Also, another approach in which initiation is related to the stress intensity factor was developed. The next phase, that of propagation, was studied using AISI 1018 steel and a new high strength steel HY-180. The crack propagation data obtained for both steels tested in air can be described accurately by the power law first suggested by Paris, da/dN = C(deltaK)/sup n/, where a is the crack length, N the number of cycles, and C and n are material constants. However, the exponent n was found to be two times larger for AISI 1018 steel than HY-180 steel. ERA

N78-32510# National Technical Information Service, Springfield, Va.
STRUCTURAL MECHANICS SOFTWARE, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Final Report, May 1975 - May 1978
George W. Reimherr Jun. 1978 219 p Supersedes NTIS/PS-77/0525; NTIS/PS-76/0437; NTIS/PS-75/428; COM-74-10833
(NTIS/PS-78/0551/8; NTIS/PS-77/0525; NTIS/PS-76/0437; NTIS/PS-75/428; COM-74-10833) Avail: NTIS HC $28.00/MF $28.00 CSCL 20K

The use of computer programs in structural analysis-design problems are cited. Detailed analyses are included of structural problems--applied and theoretical--including stress analysis, vibration, deformation, etc. The major computer programs cited in this report are NASTRAN, EPSOLA, SUPERSCEPTRE, and SINGER. (This updated bibliography contains 213 abstracts, 63 of which are new entries to the previous edition.) GRA

N78-32511# National Technical Information Service, Springfield, Va.
FINITE ELEMENTS IN STRUCTURAL ANALYSIS, VOLUME 1. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1972 - Jun. 1977
George W. Reimherr Jun. 1978 250 p
(NTIS/PS-78/0638/3) Avail: NTIS HC $28.00/MF $28.00 CSCL 20K

Finite element analysis as applied to dynamic and static problems are analyzed, as well as linear and nonlinear problems. Some computer programs for finite element analysis are also presented. GRA

N78-32512# National Technical Information Service, Springfield, Va.
FINITE ELEMENTS IN STRUCTURAL ANALYSIS, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Jul. 1977 - May 1978
George W. Reimherr Jun. 1978 83 p Supersedes NTIS/PS-77/0569; NTIS/PS-76/0525; NTIS/PS-75/496
(NTIS/PS-78-0639; NTIS/PS-77/0569; NTIS/PS-76/0525; NTIS/PS-75/496) Avail: NTIS HC $28.00/MF $28.00 CSCL 20K

The bibliography cites Government-sponsored research reports concerning finite element analysis as applied to structural mechanics problems. Some computer programs are mentioned. GRA

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N78-32513*# Department of the Environment, Ottawa (Ontario).
RETRANSMISSION OF HYDROMETRIC DATA IN CANADA Final Report, Jul. 1974 - Mar. 1978
R. A. Halliday, Principal Investigator and I. A. Reid Apr. 1978 34 p refs Sponsored by NASA ERTS
(E78-10179; NASA-CR-157274) Avail: NTIS HC A03/MF A01 CSCL 08H

The author has identified the following significant results. The LANDSAT program has demonstrated that polar orbiting satellites can be used to relay hydrologic data from any part of Canada to a user without difficulty and at low cost. These data can be used for many operational purposes, the most important of which were identified as follows: hydroelectric power plant operation; water supply for municipalities, industries, and irrigation; navigation; flood forecasting; operation of flood control structures and systems; and recreation.

N78-32514*# Environmental Research and Technology, Inc., Concord, Mass.
INVESTIGATION OF THE APPLICATION OF HCMM THERMAL DATA TO SNOW HYDROLOGY Progress Report, Jul. - Sep. 1978
James C. Barnes, Principal Investigator 28 Sep. 1978 5 p Sponsored by NASA ERTS
(E78-10194; NASA-CR-157384) Avail: NTIS HC A02/MF A01 CSCL 08H

There are no author-identified significant results in this report.

N78-32515*# Pennsylvania State Univ., University Park. Dept. of Meteorology.
APPLICATIONS OF HCMM SATELLITE DATA TO THE STUDY OF URBAN HEATING PATTERNS Quarterly Report, 1 Jun. - 31 Aug. 1978
Toby N. Carlson, Principal Investigator 1 Sep. 1978 7 p refs ERTS
(Contract NAS5-24264)
(E78-10210; NASA-CR-157583; Rept-3) Avail: NTIS HC A02/MF A01 CSCL 13B

There are no author-identified significant results in this report.

N78-32516*# National Oceanic and Atmospheric Administration, Washington, D. C.
APPLICATIONS OF HCMM DATA TO SOIL MOISTURE SNOW AND ESTUARINE CURRENT STUDIES
Donald R. Wiesnet, Principal Investigator 15 Sep. 1978 3 p Sponsored by NASA ERTS
(E78-10211; NASA-CR-157584; Rept-4) Avail: NTIS HC A02/MF A01 CSCL 08H

There are no author-identified significant results in this report.

N78-32517*# Geological Survey, Denver, Colo.
GEOLOGIC APPLICATION OF THERMAL-INERTIA MAPPING FROM SATELLITE Progress Report, 1 Jun. - 31 Aug. 1978
Terry W. Offield, Principal Investigator, Susanne H. Miller, and Kenneth Watson Aug. 1978 6 p Sponsored by NASA ERTS
(E78-10212; NASA-CR-157585) Avail: NTIS HC A02/MF A01 CSCL 08B

The author has identified the following significant results. The proportional and linear relationship between absolute and relative thermal inertia was theoretically evaluated, and a more accurate expression for thermal inertia was proposed. Radiometric and meteorological data from three stations in the Powder River Basin were acquired, as well as 400 miles of low altitude scanner data between July 25-28.

N78-32518*# Delaware Univ., Newark. College of Marine Studies.
REMOTE SENSING OF COASTAL POLLUTANTS
V. Klemas, Principal Investigator 1978 2 p Presented at UN Intern. Seminar on the Benefits of Remote Sensing for National Development, Manila, Philippines, 17-19 Apr., 1978 Sponsored by NASA ERTS
(E78-10213; NASA-CR-157586) Avail: NTIS HC A02/MF A01 CSCL 13B

There are no author-identified significant results in this report.

N78-32519*# Missouri Univ., Columbia.
APPLICATION TRANSFER ACTIVITY IN MISSOURI Final Report, Jan. 1976 - Jun. 1978
David J. Barr and Chris J. Johannsen Sep. 1978 44 p refs (Contract NAS8-31767)
(NASA-CR-150805) Avail: NTIS HC A03/MF A01 CSCL 05B

Experimental demonstrations and workshop instructional courses were conducted to transfer the technology of satellite remote sensing to a wide audience of resource managers. This audience included planning commissions, state agencies, federal agencies, and special councils of the Governor. Some of the experiments and workshops are outlined. J.M.S.

N78-32520*# Geological Survey, University, Ala.
REMOTE SENSING OF STRIPPABLE COAL RESERVES AND MINE INVENTORY IN PART OF THE WARRIOR COAL FIELD IN ALABAMA Final Report
Thomas J. Joiner, Charles W. Copeland, Jr., Donald D. Russell, Francis E. Evans, Jr., C. Daniel Sapp, and Peter A. Boone Jul. 1978 128 p refs
(Contract NAS8-31573)
(NASA-CR-150781) Avail: NTIS HC A07/MF A01 CSCL 08G

Methods by which estimates of the remaining reserves of strippable coal in Alabama could be made were developed. Information acquired from NASA's Earth Resources Office was used to analyze and map existing surface mines in a four-quadrangle area in west central Alabama. Using this information and traditional methods for mapping coal reserves, an estimate of remaining strippable reserves was derived. Techniques for the computer analysis of remotely sensed data and other types of available coal data were developed to produce an estimate of strippable coal reserves for a second four-quadrangle area. Both areas lie in the Warrior coal field, the most prolific and active of Alabama's coal fields. They were chosen because of the amount and type of coal mining in the area, their location relative to urban areas, and the amount and availability of base data necessary for this type of study. J.M.S.

N78-32521*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
RESEARCH IN SUPPORT OF THE EODAP VALIDATION PROGRAM AND SOLID EARTH GEOPHYSICS Final Report, 1 Dec. 1976 - 30 Sept. 1977
E. M. Gaposchkin Sep. 1978 79 p refs
(Grant NsG-5148)
(NASA-CR-157422) Avail: NTIS HC A05/MF A01 CSCL 08B

A validation program to verify that geodetic space techniques can measure intersite distances of several hundred to several thousand kilometers and polar motion, both with a precision of about 5 cm is described. Laser data were analyzed using a new analytical approach 'scalar translocation.' It was found that this approach can give geodynamic information and that the method is promising and can be used on a variety of satellites with data of different accuracy. J.M.S.

N78-32522*# Mitre Corp., McLean, Va. Metrek Div.
THE CAPABILITY OF SATELLITE BORNE REMOTE SENSORS TO MEASURE STRATOSPHERIC TRACE CONSTITUENTS. VOLUME 1: BACKGROUND AND REQUIREMENTS
Edwin L. Keitz May 1978 216 p refs Sponsored by NASA 3 Vol.
(Contract F19628-77-C-0001)
(NASA-CR-145309; MTR-7519-Vol-1) Avail: NTIS HC A10/MF A01 CSCL 04A

Volume 1 of a three volume report issued as MITRE/METREX Technical Report is presented. This volume contains a synthesis of the results of two previous MITRE/METREX studies and an update of the information. These studies deal with a comprehensive review of stratospheric trace constituent measurement requirements. The scope of the study was restricted to those contituents which fall into the general category of air pollutants. G.Y.

N78-32523*# Mitre Corp., McLean, Va. Sponsored by NASA
THE CAPABILITY OF SATELLITE BORNE REMOTE SENSORS TO MEASURE STRATOSPHERIC TRACE CONSTITUENTS. VOLUME 2: OZONE AND AEROSOL RELATED MISSIONS
Edwin L. Keitz May 1978 147 p refs 3 Vol.
(Contract F19628-77-C-0001)
(NASA-CR-145309; MTR-7519-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 04A

Stratospheric trace constituent measurement requirements are separated into two somewhat overlapping areas. In the first area, it is assumed that the only problem of interest is ozone; its chemistry chain, environmental effects and measurement requirements. In like manner, in the second area it is assumed that the only problem of interest is stratospheric aerosols; their chemistry, effects and measurement requirements. G.Y.

N78-32524*# Mitre Corp., McLean, Va. Metrek Div.
THE CAPABILITY OF SATELLITE BORNE REMOTE SENSORS TO MEASURE STRATOSPHERIC TRACE CONSTITUENTS. VOLUME 3: SUPPORTING MATERIAL
Edwin L. Keitz May 1978 99 p refs Sponsored by NASA 3 Vol.
(Contract F19628-77-C-0001)
(NASA-CR-145309; MTR-7519-Vol-3) Avail: NTIS HC A05/MF A01 CSCL 04A

Contained in this volume is material of a supportive nature not considered to be of sufficient importance to be included in the other two previous volumes. This material is of two types:(1) information and numerical evaluations used in the development of mission evaluations for stratospheric trace constituent measurement;and (2) various spatial and temporal distributions for those stratospheric trace species having sufficient measurements available to warrant their presentation. G.Y.

N78-32525*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RED AND PHOTOGRAPHIC INFRARED LINEAR COMBINATIONS FOR MONITORING VEGETATION
Compton J. Tucker May 1978 37 p refs Submitted for publication
(NASA-TM-79620) Avail: NTIS HC A03/MF A01 CSCL 08F

In situ collected spectrometer data were used to evaluate and quantify the relationships between various linear combinations of red and photographic infrared radiances and experimental plot biomass, leaf water content, and chlorophyll content. The radiance variables evaluated included the red and photographic infrared (IR) radiance and the linear combinations of the IR/red ratio, the square root of th IR/red difference, the vegetation index, and the transformed vegetation index. In addition, the corresponding green and red linear combinations were evaluated for comparative purposes. Three data sets were used from June, September, and October sampling periods. Regression analysis showed the increase utility of the IR and red linear combinations vis-a-vis the same green and red linear combinations. The red and IR linear combinations had 7% and 14% greater regression significance than the green and red linear combinations for the June and September sampling periods, respectively. The VI, TVI, and square root of the IR/red ration were the most significant followed closely by the IR/red ratio. Less than 6% difference separated the highest and lowest of these four IR and red linear combinations. The use of these linear combinations was shown to be sensitive primarily to the green leaf area or green leaf biomass. Author

N78-32526*# Ecosystems International, Inc., Gambrills, Md.
APPLICATIONS OF REMOTE SENSING TO HYDROLOGIC PLANNING Final Report
Harry Loats, Jr., Thomas Fowler, and Peter Castruccio Aug. 1978 148 p
(Contract NAS8-32423)
(NASA-CR-3041; M-258) Avail: NTIS HC A07/MF A01 CSCL 08H

The transfer of LANDSAT remote sensing technology from the research sector to user operational applications requires demonstration of the utility and accuracy of LANDSAT data in solving real problems. This report describes such a demonstration project in the area of water resources, specifically the estimation of non-point source pollutant loads. Non-point source pollutants were estimated from land cover data from LANDSAT images. Classification accuracies for three small watersheds were above 95%. Land cover was converted to pollutant loads for a fourth watershed through the use of coefficients relating significant pollutants to land use and storm runoff volume. These data were input into a simulator model which simulated runoff from average rainfall. The result was the estimation of monthly expected pollutant loads for the 17 subbasins comprising the Magothy watershed. Author

N78-32527*# Radio Corp. of America, Camden, N. J. Government Communications Systems Div.
KRYTOX LUBRICATION TAPE STUDY Technical Report, Nov. 1975 - Aug. 1976
Frank Lee Apr. 1978 37 p
(Contract NAS5-22574)
(NASA-CR-156827) Avail: NTIS HC A03/MF A01 CSCL 14B

The use of Krytox, a fluorinated oil, as a tape surface lubricant was studied for a wideband video tape recorder. In spite of the 5 to 1 head wear reduction credited to the surface lubricant, the resultant head life fell short of the 1500 hour goal. G.G.

N78-32528# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
SHADED PERSPECTIVE IMAGE OF TERRAIN
Thomas M. Strat Mar. 1978 39 p refs
(Contract N00014-75-C-0643)
(AD-A055070; AI-M-463) Avail: NTIS HC A03/MF A01 CSCL 08/2

In order to perform image analysis, one must have a thorough understanding of how images are formed. This memo presents an algorithm that produces shaded perspective images of terrain as a vehicle to understanding the fundamentals of image formation. The image is constructed using standard projection equations along with an efficient hidden-surface removal technique. The image intensity is calculated using the reflectance map, a convenient way of describing the surface reflection as a function of surface gradient. Aside from its use as a tool toward understanding image analysis, the algorithm has several applications of its own, including providing video input to a flight simulator. Author (GRA)

N78-32529# Massachusetts Inst. of Tech., Cambridge. Operations Research Center.
NORMATIVE MODELS OF DEPLETABLE RESOURCES
Eduardo M. Modiano May 1978 315 p refs
(Contract DAAG29-76-C-0064)
(AD-A055736; ARO-14261.8-M) Avail: NTIS HC A14/MF A01 CSCL 05/3

The major theme of this work is the integration of depletable resources supply and sectoral dynamic models. These models are inherently normative due to their mathematical programming formulations. The economic sectors that demand the depletable resource minimize in each time period the cost of meeting the demand for end-use goods. The suppliers allocate the fixed

resource stock over time such as to maximize the net present value of profits. Equilibrium is defined by linking the suppliers: revenue with sectoral savings in costs. Mathematical programming concepts, particularly decomposition methods, facilitate the integration of these models. Finite-horizon approximation methods for the case of infinite planning horizons are presented. These are of particular interest in the integration of transient and stationary stage models. Leontief substitution systems are also considered. Finite-elasticities in the demand for end-use goods and the supply of alternative primary supplies add more flexibility to the equilibrium model. GRA

N78-32530# SRI International Corp., Menlo Park, Calif.
INTERACTIVE AIDS FOR CARTOGRAPHY AND PHOTO INTERPRETATION Semiannual Technical Report, 2 Nov. 1977 - 11 May 1978
G. J. Agin, H. G. Barrow, R. C. Bolles, M. A. Fischler, and T. D. Garvey Jun. 1978 31 p
(Contract DAAG29-76-C-0057; ARPA Order 2894)
(AD-A056355; ARO-14305.1-A-EL) Avail: NTIS HC A03/MF A01 CSCL 14/5

The central scientific goal of the ARPA Image Understanding Project research program is to investigate and develop ways in which diverse sources of knowledge may be brought to bear on the problem of interpreting images. The research is concerned with specific problems that arise in processing aerial photographs for such military applications as cartography, intelligence, weapon guidance, and targeting. A key concept is the use of a generalized digital map to guide the process of image analysis. The objectives, methodology, and current status of the research are described in this report. In the present phase of the program, the primary focus is on developing a 'road expert,' whose purpose is to monitor and interpret road events in aerial imagery. Also described are the details of an innovative procedure for tracking road segments and finding potential vehicles in imagery of approximately 1-3 feet per pixed ground resolution. This work represents an important contribution toward achieving the indicated goals. Author (GRA)

N78-32531# Grand Junction Office (AEC), Colo. Production Evaluation Div.
GEOCHEMICAL AND GEOPHYSICAL RECONNAISSANCE IN NORTHERN PENINSULA MICHIGAN AND NORTHEASTERN WISCONSIN
R. L. Kinnaman and C. T. Illsley Mar. 1978 146 p refs
(Contract EY-76-C-13-1664)
(RME-1099) Avail: NTIS HC A07/MF A01

About 600 water samples were collected from streams and subsurface sources during a reconnaissance study for U in an area of about 7,000 square miles. Analyses were made for U and total conductivity was determined on all samples. Most samples were also analyzed for bicarbonate and sulfate ion, and supporting analyses were run on selected solid samples from the geologic and hydrologic environment. Results indicated the feasibility of hydrogeochemical methods for detection of U introduced into surface waters by small, low grade ore deposits. Areal water sampling results in Michigan and Wisconsin were treated statistically to obtain cutoff values for parameters used in differentiating anomalies from background values in water samples. Significant parameters are uranium content and total conductivity. Several drainage areas in Michigan and Wisconsin were sampled which contained anomalous amounts of uranium, ranging from about 0.8 to 10.4 ppB U3O8. ERA

N78-32532# North Carolina State Univ., Raleigh.
AN EVALUATION OF THE POTENTIAL FOR USING DRAINAGE CONTROL TO REDUCE NITRATE LOSS FROM AGRICULTURAL FIELDS TO SURFACE WATERS
J. W. Gilliam, R. W. Skaggs, and S. B. Weed Jan. 1978 121 p refs
(Contract DI-14-34-0001-7070)
(PB-280575/2; UNC-WRRI-78-128; W78-06578; OWRT-A-083-NC(2)) Avail: NTIS HC A06/MF A01 CSCL 08H

It was revealed that considerable denitrification occurred in poorly drained soils with high water tables. This resulted in less nitrate leaving fields in drainage waters than occurred in better drained soils. Two North Carolina coastal plain sites were used: one in the poorly drained soils of the tidewater area and the other in the moderately well drained soils of the lower coastal plains. Flashboard riser type water control structures were installed in four main tile lines at each location. Each control structure was equipped with a weir and a stage recorder for computing total outflow of drainage water. A semi-proportional water sampler was installed at each weir to take samples for chemical analyses. The structures were very effective in controlling the loss of nitrate-nitrogen on the moderately well drained soils. GRA

N78-32533# National Oceanic and Atmospheric Administration, Ann Arbor, Mich. Great Lakes Environmental Research Lab.
A GENERAL CIRCULATION MODEL FOR LAKES
J. C. K. Huang Aug. 1977 47 p refs
(PB-281834/2; NOAA-TM-ERL-GLERL-16; GLERL-Contrib-122; NOAA-78042610) Avail: NTIS HC A03/MF A01 CSCL 08H

A time-dependent, three-dimensional numerical dynamic model for a large lake, possessing the actual coastal configuration and bottom topography of the lake and with a flexible number of vertical layers, has been developed to simulate the organized water motion and temperature structure throughout the annual cycle of the lake and to understand the physical nature of the lake in response to atmospheric forcing. The model is based on time integration of the finite difference form of the primitive equations. Fresh water density is approximated as a quadratic function of temperature. Lake circulation is driven by imposed meteorological conditions. The flux form of a mass, momentum, and energy conservation numerical scheme is used for the finite difference equations of the mdoel. Results show that the whole lake response of Lake Ontario is dominantly barotrophic and gradually becomes baroclinic. GRA

N78-32534*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT 2 WORLD STANDARD CATALOG, 1 MAY - 31 JULY 1978
31 Jul. 1978 322 p
(NASA-TM-79935; GSFC/LWC2-78/07; NTISUB/D/276-007) Avail: NTIS HC A14/MF A01 CSCL 05B

Information regarding the availability of LANDSAT imagery processed and input to the data files by the NASA Data Processing Facility is published on a monthly basis. The U.S. Standard Catalog includes imagery covering the continental United States, Alaska and Hawaii. The Non-U.S. Standard Catalog identifies all the remaining coverage. Sections 1 and 2 describe the contents and format for the catalogs and the associated microfilm. Section 3 provides a cross-reference defining the beginning and ending dates for LANDSAT cycles. Author

N78-32535# National Technical Information Service, Springfield, Va.
WATER QUALITY MODELING-HYDROLOGICAL AND LIMNOLOGICAL SYSTEMS, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1975 - Jun. 1977
Edward J. Lehmann Jun. 1978 192 p
(NTIS/PS-78/0649/0) Avail: NTIS HC $28.00/MF $28.00 CSCL 08H

Information on models used to describe water quality, including models of the chemical, physical, biological, and hydrological processes important to water quality is given. The modeling of eutrophication, nutrient removal, pollutant dispersion, stream flow, heat dissipation, limnological factors, acquifer water quality, and water runoff quality is included. GRA

N78-32536# National Technical Information Service, Springfield, Va.
WATER QUALITY MODELING HYDROLOGICAL AND LIMNOLOGICAL SYSTEMS, VOLUME 3. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Jul. 1977 - Jun. 1978
Edward J. Lehmann Jun. 1978 93 p Supersedes NTIS/PS-77/0528; NTIS/PS-76/0444; NTIS/PS-75/441; COM-74-10938 (NTIS/PS-78/0650/8; NTIS/PS-77/0528; NTIS/PS-76/0444; NTIS/PS-75/441; COM-74-10938) Avail: NTIS HC $28.00/MF $28.00 CSCL 08H

This updated bibliography contains 86 abstracts. Chemical, physical, biological, and hydrological processes important to water quality are covered. Other topics included are: eutrophication,

nutrient removal, pollutant dispersion, stream flow, heat dissipation, limnological factors, aquifer water quality, and water runoff quality. GRA

N78-32537# National Technical Information Service, Springfield, Va.
SOIL EROSION CONTROL. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Jun. 1978
Guy E. Habercom, Jr. Jun. 1978 289 p Supersedes NTIS/PS-77/0571; NTIS/PS-76/0496; NTIS/PS-75/469; COM-73-11803
(NTIS/PS-78/0641/7; NTIS/PS-77/0571; NTIS/PS-76/0496; NTIS/PS-75/469; COM-73-11803) Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

Soil erosion sources and control methods are reviewed. Abstracts are included of reports relative to beach and highway erosion control and forward area airfield dust control. (This updated bibliography contains 282 abstracts, 28 of which are new entries to the previous edition.) GRA

N78-32538*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT 3 WORLD STANDARD CATALOG, 6 MARCH - 31 JULY 1978
Jul. 1978 531 p
(NASA-TM-79902; GSFC/LWC3-78/07; NTISUB/D/277-007)
Avail: NTIS HC A23/MF A01 CSCL 05B

The World Standard Catalog lists imagery acquired by LANDSAT 3 which was processed and input to the data files during the referenced period. Information such as date of entry, cloud cover, and image quality is given for each scene. The microfilm roll and frame on which the scene may be found is also indicated. A.R.H.

N78-32134# Indian Inst. of Science, Bangalore.
REMOTE SENSING
Y. V. Venkatesh *In its* Space Sci., Technol. and Appl.: An Overview Apr. 1978 11 p refs (For primary document see N78-32114 23-12)
Avail: NTIS HC A10/MF A01

N78-32152*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VLBI-LASER INTERCOMPARISON PROJECT
B. D. L. Mulhall *In its* The Deep Space Network 15 Aug. 1978 p 87-91 (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 08B

N78-33020# Joint Publications Research Service, Arlington, Va.
DIRECTOR OF PRIRODA CENTER STRESSES SIGNIFICANCE OF SPACE PHOTOGRAPHY
Yu. Kiyenko *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 42 (JPRS-71612) 3 Aug. 1978 p 68-71 Transl. into ENGLISH from Pravda (Moscow), 24 Jun. 1978 p 3 (For primary document see N78-33015 23-99)
Avail: NTIS HC A05/MF A01

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N78-32539* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
INDEPENDENT POWER GENERATOR Patent
Richard N. Young, inventor (to NASA) Issued 30 May 1978 6 p Filed 30 Jul. 1976 Supersedes N78-10096 (16 - 01, p 14)
(NASA-Case-LAR-11208-1; US-Patent-4,091,613; US-Patent-Appl-SN-710036; US-Patent-Class-60-39.07; US-Patent-Class-60-39.14; US-Patent-Class-60-39.33; US-Patent-Class-98-1.5; US-Patent-Class-417-88) Avail: US Patent Office CSCL 10B

A gas turbine powered aircraft auxiliary power system is described which is capable of efficiently supplying all aircraft auxiliary services both in flight and on the ground and is further capable of operating independently of the aircraft main engines. The system employs multiple gas turbine compressor stages, thereby accomplishing cabin pressurization, ventilation and heating. Official Gazette of the U.S. Patent Office

N78-32540 State Univ. of New York at Binghamton.
AN ECONOMETRIC ANALYSIS OF THE ROLE OF AIR AND WATER RESIDUALS IN THE PRODUCTION TECHNOLOGY FOR STEAM-GENERATING ELECTRIC PLANTS Ph.D. Thesis
Tran Thi Ngoc Bich 1977 221 p
Avail: Univ. Microfilms Order No. 78-05543

A production technology model was developed: (1) to assess the role of air- and water-borne residuals in the production technology of the plants; (2) to estimate the partial elasticities of substitution between labor and fuel; (3) to test input homotheticity of the production technology; (4) to test the hypotheses of separability betweeen the joint outputs (i.e., electricity and residuals emissions) and factor inputs (labor and fuel). Estimates of the role of air- and water-borne emissions in the ex post production technology for the 128 fossil-fuel fired steam-generating plants constructed during the period of 1948 to 1968 in the United States are presented. The overall results strongly support the inclusion of both air- and water-borne residuals measures in estimating the nature of the production technology for fossil-fuel plants for all vintages. Dissert. Abstr.

N78-32541 Southern Illinois Univ. at Carbondale.
THE FEASIBILITY OF SOLAR HOUSE HEATING: A STUDY IN APPLIED ECONOMICS Ph.D. Thesis
Ali Shams 1977 120 p
Avail: Univ. Microfilms Order No. 7804312

The performance of a solar heating system for the average single family house in St. Louis, Missouri was examined. The optimal mix of solar and conventional forms of heating, taking into account the factors of climate, heat loss coefficient of residential structures, fuel costs, and capital costs associated with solar heating systems of varying sizes was determined. A simulation model was used to measure the annual performance of a solar heating system design of varying capacities. The optimal mix of solar and conventional heat sources was found where the present value of the savings on conventional fuel, taken over the life of the system, is equal to the cost of the system at the margin. The present value of the marginal savings on conventional fuel resulting from the utilization of the solar heating system was compared with the capital cost of the system.
Dissert. Abstr.

N78-32542* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
OCEAN THERMAL PLANT Patent
Lester J. Owens, inventor (to NASA) Issued 9 May 1978 10 p Filed 29 Mar. 1977 Supersedes N77-21666 (15 - 12, p 1621)
(NASA-Case-KSC-11034-1; US-Patent-4,087,975; US-Patent-Appl-SN-782481; US-Patent-Class-60-641; US-Patent-Class-60-671) Avail: US Patent Office CSCL 10A

A floating energy converter is described which uses large volumes of sea water to produce electrical power. In this plant, a fluid working medium is pumped to an evaporator where is is heated by a flow of warm surface sea water. The fluid in liquid form boils to a pressurized gas vapor which is routed to drive a turbine that, in turn, drives a generator for producing electricity. The gas vapor then enters a condenser immersed in cold sea water pumped from lower depths, condenses to its original liquid form, and then pumped to the evaporator to repeat the cycle. Modular components can be readily interchanged on the ocean thermal unit and inlet pipes for the sea water are provided with means for maintaining the pipes in alignment with the oncoming current. The modular construction allows for the testing of various

components to provide a more rapid optimization of a standardized plant. Official Gazette of the U.S. Patent Office

N78-32543*# Reedy Creek Utilities Co., Inc., Lake Buena Vista, Fla.
SOLAR HEATING AND COOLING SYSTEM FOR AN OFFICE BUILDING AT REEDY CREEK UTILITIES
Aug. 1978 213 p Sponsored by NASA
(Contract EX-76-C-01-2401)
(NASA-CR-150748) Avail: NTIS HC A10/MF A01 CSCL 10A

The solar energy system installed in a two story office building at a utilities company, which provides utility service to Walt Disney World, is described. The solar energy system application is 100 percent heating, 80 percent cooling, and 100 percent hot water. The storage medium is water with a capacity of 10,000 gallons hot and 10,000 gallons chilled water. Performance to date has equaled or exceeded design criteria. J.M.S.

N78-32544*# Little (Arthur D.), Inc., Cambridge, Mass.
ASSESSMENT OF INDUSTRIAL APPLICATIONS FOR FUEL CELL COGENERATION SYSTEMS
R. P. Stickles, J. K. ONeill, and E. H. Smith Sep. 1978 210 p refs
(Contract NAS3-20818)
(NASA-CR-135429; C-81173) Avail: NTIS HC A10/MF A01 CSCL 10A

The fuel cell energy systems are designed with and without a utility connection for emergency back-up power. Sale of electricity to the utility during periods of low plant demand is not considered. For each of the three industrial applications, conceptual designs were also developed for conventional utility systems relying on purchased electric power and fossil-fired boilers for steam/hot water. The capital investment for each energy system is estimated. Annual operating costs are also determined for each system. These cost estimates are converted to levelized annual costs by applying appropriate economic factors. The breakeven electricity price that would make fuel cell systems competitive with the conventional systems is plotted as a function of naphtha price. The sensitivity of the breakeven point to capital investment and coal price is also evaluated. Author

N78-32545*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CHARACTERIZATION OF SOLAR CELLS FOR SPACE APPLICATIONS. VOLUME 3: ELECTRICAL CHARACTERISTICS OF OCLI HYBRID MLAR SOLAR CELLS AS A FUNCTION OF INTENSITY AND TEMPERATURE
R. G. Downing and R. S. Weiss 1 Sep. 1978 39 p refs
(Contract NAS7-100)
(NASA-CR-157605; JPL-Pub-78-15-Vol-3) Avail: NTIS HC A03/MF A01 CSCL 10A

Electrical characteristics of hybrid multilayer antireflectance coated silicon solar cells are presented in graphical and tabular format as a function of solar illumination intensity and temperature. Author

N78-32546*# Honeywell, Inc., Minneapolis, Minn. Energy Resource Center.
SOLAR HEATING AND COOLING SYSTEMS DESIGN AND DEVELOPMENT
Jul. 1978 22 p Prepared for DOE
(Contract NAS8-32093)
(NASA-CR-150786) Avail: NTIS HC A02/MF A01 CSCL 10A

The development and delivery of prototype solar heating and cooling systems for installation and operational test are detailed. G.G.

N78-32547*# Solafern Ltd., Bourne, Mass.
INSTALLATION PACKAGE FOR A DOMESTIC SOLAR HEATING AND HOT WATER SYSTEM
Aug. 1978 51 p Prepared for DOE
(Contract NAS8-32246)
(NASA-CR-150760) Avail: NTIS HC A04/MF A01 CSCL 10A

The installation of two prototype solar heating and hot water systems is described. The systems consists of the following subsystems: solar collector, storage, control, transport, and auxiliary energy. G.G.

N78-32548*# Northrup, Inc., Hutchins, Tex.
INSTALLATION PACKAGE FOR CONCENTRATING SOLAR COLLECTOR PANELS
Aug. 1978 55 p Prepared for DOE
(Contract NAS8-32251)
(NASA-CR-150780) Avail: NTIS HC A04/MF A01 CSCL 10A

The concentrating solar collector panels comprise a complete package array consisting of collector panels using modified Fresnel prismatic lenses for a 10 to 1 concentrating ratio, supporting framework, fluid manifolding and tracking drive system, and unassembled components for field erection. G.G.

N78-32549*# Colt, Inc. of Southern California, Rancho Mirage.
PROTOTYPE SOLAR HEATING AND HOT WATER SYSTEMS Quarterly Reports, 1 Oct. 1977 - 30 Jun. 1978
Apr. 1978 16 p Prepared for DOE
(Contract NAS8-32242)
(NASA-CR-150785) Avail: NTIS HC A02/MF A01 CSCL 10A

Two prototype solar heating and hot water systems are reported that of the following subsystems: collector, storage, control, transport, hot water, and auxiliary energy. G.G.

N78-32550*# Colt, Inc. of Southern California, Rancho Mirage.
INSTALLATION PACKAGE FOR A SOLAR HEATING AND HOT WATER SYSTEM
Aug. 1978 76 p Prepared for DOE
(Contract NAS8-32242)
(NASA-CR-150757) Avail: NTIS HC A05/MF A01 CSCL 10A

Development and installation of two commercial solar heating and hot water systems are reported. The systems consist of the following subsystems: collector, storage, transport, hot water, auxiliary energy and controls. General guidelines are provided which may be utilized in development of detailed installation plans and specifications. In addition, operation, maintenance and repair of a solar heating and hot water system instructions are included. G.G.

N78-32551*# Naval Weapons Support Center, Crane, Ind.
EVALUATION PROGRAM FOR SECONDARY SPACECRAFT CELLS: SYNCHRONOUS ORBIT TESTING OF SEALED NICKEL CADMIUM CELLS
J. D. Harkness 9 Jun. 1977 519 p
(NASA Order S-53742-AG)
(NASA-CR-156814; WQEC/C-77-134) Avail: NTIS HC A22/MF A01 CSCL 10C

Performance data concerning sealed nickel-cadmium cells operating under a synchronous orbit regime are presented. A space satellite maintaining a position over a fixed point on earth as the earth rotates on its axis and revolves about the sun was simulated. Results include: (1) exposure to synchronous orbit testing at a temperature of 40 C yields less than 6 years of life; (2) performance at -20 C presents a low capacity problem; (3) the capacity check, performed at the middle of each show period, provides a temporary red reconditioning effect on the cells in that the end-of-discharge voltages are higher, for approximately 7 to 10 days, following the capacity check than they were 7 to 10 days prior to the capacity check; (4) all the test packs at -20 C and 40 C have either failed or were discontinued because of low capacity; and (5) test packs at temperatures of 0 C and 10 C have delivered the best capacity during life and packs tested at 20 C showed better life capability than packs tested at -20 C and 40 C. J.M.S.

N78-32552# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio. Energy Conversion Branch.
USAF TERRESTRIAL ENERGY STUDY. VOLUME 1: EXECUTIVE SUMMARY Final Report, 1 Apr. 1976 - 1 Feb. 1978
David C. Hall Apr. 1978 29 p
(Contract E(49-28)-1013; AF Proj. 3145)
(AD-A055213; AFAPL-TR-78-19-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 10/2

Present and future Terrestrial Power (Electrical and Thermal) requirements of the Air Force are summarized and categorized at both base and subbase level, with consideration given to applicable energy conversion technology and potentials.
Author (GRA)

N78-32553# EIC, Inc., Newton, Mass.
BASIC STUDIES OF THE LITHIUM SECONDARY ELECTRODE Technical Report, 1 Feb. 1977 - 31 Jan. 1978
S. Barry Brummer, Victor R. Koch, and Jack H. Young Mar. 1978 34 p refs
(Contract N00014-77-C-0155)
(AD-A054792; C-480-1; TR-1) Avail: NTIS HC A03/MF A01 CSCL 10/3

As part of a basic study of the secondary Li electrode, the reactions of tetrahydrofuran (THF) with Li have been evaluated. Tetrahydrofuran is reductively cleaved by Li to lithium n-butoxide (BuOLi), the enolate anion of acetaldehyde, and ethylene. The AsF6anion is reduced by Li to AsF3 which further reacts with BuOLi to form a brown film on Li. The brown film appears to be composed of an (-As-O-As-)n polymer and LiF. These products were observed to form irrespective of electrolyte purification procedure. In fact, highly purified media reacted most readily with Li presumably due to the absence of protective film-forming gases such as O2 and N2. Extended pre-electrolysis of LiClO4/THF electrolytes formed large amounts of basic material, as expected. The same experiment performed on LiAsF6/THF electrolyte revealed essentially no change in the medium's pH. Apparently, the AsF3 from AsF6- and the basic material from THF degradation effectively neutralize each other. A mechanism which accounts for Li-cyclic ether reactivity is proposed. Author (GRA)

N78-32554# Research Triangle Inst., Research Triangle Park, N. C.
PHOTODIODE DESIGN STUDY Final Report, May - Dec. 1977
M. F. Lamorte Dec. 1977 81 p refs
(Contract F33615-76-C-1283)
(AD-A055794; AFAL-TR-77-230) Avail: NTIS HC A05/MF A01 CSCL 10/2

The purpose of this work was to apply the analytical method developed for single junction and multijunction solar cells, Contract No. F33615-76-C-1283, to photodiodes and avalanche photodiodes. It was anticipated that this analytical method will advance the state-of-the-art because of the following: (1) the analysis considers the total photodetector multilayer structure rather than just the depleted region; (2) a model of the complete band structure is analyzed; (3) application of the integral form of the continuity equation is used; (4) structures that reduce dark current and/or increase the ratio of photocurrent to dark current are obtained; and (5) structures that increase spectral response in the depleted region and reduce response in other regions of the diode are obtained. The integral form of the continuity equation developed for solar cells is the steady-state or time-independent form. The contract specified that the time-independent equation would only be employed to determine applicability to photodetectors. The GaAsSb photodiode under development at Rockwell International, Thousand Oaks, California was used to determine the applicability to photodetectors. The diode structure is composed of four layers grown on a substrate. The analysis in Section 5.0 presents calculations of spectral response. This parameter is used in this study to optimize the structure. GRA

N78-32555# Research, Analysis and Development Corp., Colorado Springs, Colo.
WASTE ENERGY RECOVERY STUDY Final Report, Apr. - Dec. 1977
Robert A. Golobic, Dennis A. Mrkvicka, and Harold C. Schlicht May 1978 212 p refs
(Contract F08635-77-C-0126)
(AD-A055452; AFCEC-TR-78-4) Avail: NTIS HC A10/MF A01 CSCL 13/2

Part I of this report outlines the techniques used for determining appropriate schemes for energy recovery. Both thermodynamic and economic considerations are presented. Part 2 contains rejected-energy recovery studies for facilities, which are typical at most installations Part 3 is primarily concerned with special industrial recovery systems and most examples are a result of the Tinker AFB, OK, survey. Wright-Patterson AFB, OH, was also surveyed during this study. GRA

N78-32556*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FINAL DESIGN REVIEW: MULTI-PURPOSE SENIOR CENTER, SOLAR HEATING AND HOT WATER SYSTEM
1978 11 p
(Contract EX-77-A-29-1055)
(NASA-TM-79754; TID-28140) Avail: NTIS HC A02/MF A01 CSCL 10A

Discussion at the final design review meeting on the solar heating and hot water system for the multi-purpose Senior Center is presented. Schematics of the system are included. ERA

N78-32557# California Univ., Livermore. Lawrence Livermore Lab.
GEOTHERMAL RESOURCE DEVELOPMENT: LAWS AND REGULATIONS
James C. Wharton 25 Aug. 1977 67 p refs
(Contract W-7405-eng-48)
(UCRL-52327) Avail: NTIS HC A04/MF A01

California state laws on geothermal power production are discussed. Pertinent federal and state provisions are compared and inconsistencies are reported. The question of designating theothermal resource as a mineral was also reviewed. B.B.

N78-32558# Oak Ridge Y-12 Plant, Tenn.
ECONOMY OF A RETROFIT SOLAR SYSTEM
J. M. Schreyer Sep. 1977 22 p
(Contract W-7405-eng-26)
(Y-2098) Avail: NTIS HC A02/MF A01

A privately financed solar augmented hot water system was demonstrated to pay off in less than 10 years if a loan is obtained at 10.5% interest. Calculations were made on the assumption that electricity cost 5 cents per kWh and water consumption averages 30 gallons per day. ERA

N78-32559# Battelle Pacific Northwest Labs., Richland, Wash.
SURVEY AND PRELIMINARY EVALUATION OF POTENTIAL GEOTHERMAL ENERGY APPLICATIONS FOR RIVERSIDE, CALIFORNIA
C. H. Bloomster, L. L. Fassbender, A. H. Schilling, and H. E. Lippek Mar. 1978 83 p refs
(Contract EY-76-C-06-1830)
(PNL-2597) Avail: NTIS HC A05/MF A01

A preliminary assessment of the potential applications for geothermal energy in Riverside, California, was made. The assessment includes both potential electrical and non-electrical applications, and focuses on the following factors: (1) the location of nearby geothermal resources, (2) characteristics of these resources, (3) types of applications suited to each resource, (4) technical and economic feasibility of these applications, (5) the potential impact on the energy demand of each application, and (6) potential deterrents to the utilization of geothermal energy for the most promising application. It is concluded that geothermal energy has a promising potential to supply electricity, space heating and cooling, and process heat to Riverside. ERA

N78-32560# Battelle Pacific Northwest Labs., Richland, Wash.
ECONOMIC ANALYSIS OF POTENTIAL USES OF GEOTHERMAL ENERGY IN AGRICULTURE
Bruce W. Cone Feb. 1978 78 p refs
(Contract EY-76-C-06-1830)
(PNL-2568) Avail: NTIS HC A05/MF A01

The economic feasibility and water quality considerations of the cultural practice of soil warming was evaluated using existing technical agronomic, and economic data. It was hypothesized that it is technically and economically feasible to use geothermal energy in the cultural practice of soil warming form specific crops. The analysis attempted to reject the hypothesis. Since the hypothesis could not be rejected, the results are presented as a profit equation suitable for inclusion in the GEOCOST computer program. This determination of economic feasibility utilized heterogeneous crop yield data by comparing the elasticity of response with a normalized product-factor price ratio. Soil warming was determined to be feasible when the elasticity of

production was equal to or greater than the normalized product-factor price ratio. ERA

N78-32561# Electric Power Research Inst., Palo Alto, Calif.
ELECTRIC UTILITY SOLAR ENERGY ACTIVITIES: 1977 SURVEY
L. D. Cleary Feb. 1978 133 p
(EPRI-ER-649-SR) Avail: NTIS HC A07/MF A01

Brief descriptions are given of 458 projects being conducted by 150 utility companies. Also included is a list of participating utilities with information contacts and addresses, a list of utilities with projects designated by category, and a list of utilities organized by state. ERA

N78-32562# Washington Scientific Marketing, Inc., Washington, D. C.
DEPARTMENT OF ENERGY PROGRAMS AND OBJECTIVES: FLUID WASTE HEAT RECOVERY AND UTILIZATION
Feb. 1978 36 p
(Contract W-31-109-eng-38)
(TID-28393) Avail: NTIS HC A03/MF A01

The primary objective of the Division of Industrial Energy Conservation is to improve technology that will make industry and agriculture more energy-efficient. Work to remove technological and economic barriers to enhance industrial implementation of energy-efficient processes and technology is reported. Subprograms to carry out the Division's goals are described. These are waste energy reduction; alternate materials utilization; advanced cogeneration-industrial process efficiency, and agricultural and food process efficiency. ERA

N78-32563# Electric Power Research Inst., Palo Alto, Calif.
DEMAND 77: EPRI ANNUAL ENERGY FORECASTS AND CONSUMPTION MODEL. VOLUME 1: FORECASTS AND GENERAL DESCRIPTION OF THE MODEL
L. J. Williams, J. W. Boyd, and R. T. Crow Mar. 1978 77 p refs
(EPRI-EA-621-SR-Vol-1) Avail: NTIS HC A05/MF A01

Forecasts of end-use consumption of electricity, petroleum, natural gas, and coal for the years 1980 to 2000 are presented. The forecasts are based on an econometric model whose equations represent energy consumption of each form of energy in each end-use sector. The forecasts are based on a forecast of longrun economic growth coupled with three scenarios concerning energy prices and conservation policy. Each of the scenarios was coupled with two scenarios concerning natural gas availability, one in which natural gas is freely available at the assumed price. Forecasts are presented for each of the sectors and for each of the forms of energy by five-year periods. The structure of the econometric model is described along with plans for further development. ERA

N78-32564# Department of Energy, Washington, D. C. Div. of Consumption Data Studies.
FEDERAL ENERGY DATA SYSTEM (FEDS): STATISTICAL SUMMARY
Raymond F. Fuller Feb. 1978 891 p ref
(DOE/EIA-0031/2) Avail: NTIS HC A99/MF A01

The Federal Energy Data System (FEDS) has data on annual energy consumption from 1960 through 1975, categorized by fuel, sector, and geographic area. The major fuels considered are coal, natural gas, motor gasoline, jet fuel, distillate, residual, electricity, and hydro and nuclear power. Data on petrochemical feedstocks, other petroleum products and other raw materials are also included. The sectors considered are residential, commercial, industrial, transportation, and electric utilities. The data are at the State level, with census division and national totals included. The FEDS data base also includes selected macroeconomic and demographic data. ERA

N78-32565# Department of Energy, Washington, D. C.
ENVIRONMENTAL DEVELOPMENT PLAN (EDP): SOLAR HEATING AND COOLING OF BUILDINGS, 1977
Mar. 1978 54 p refs
(DOE/EDP-0001) Avail: NTIS HC A04/MF A01

The present status and goals of ERDA's solar heating and cooling program are described. Potential environmental, health, safety, and socioeconomic impacts of solar technology development and deployment are identified and screened for key issues. A management plan is presented for conducting and coordinating environmental research in concert with technology development to ensure that environmental issues are resolved prior to significant public deployment of the technology. ERA

N78-32566# Electric Power Research Inst., Palo Alto, Calif. Fossil Fuel and Advanced Systems Div.
GEOTHERMAL ENERGY PROSPECTS FOR THE NEXT 50 YEARS. PRELIMINARY REPORT TO THE CONSERVATION COMMISSION WORLD ENERGY CONFERENCE
Feb. 1978 92 p refs
(EPRI-ER-611-SR) Avail: NTIS HC A05/MF A01

Various facets of geothermal energy-resource base, electric power potential, and potential nonelectric uses-are considered, using information derived from three sources: (1) analytic computations based on gross geologic and geophysical features of the earth's crust, (2) the literature, and (3) a worldwide questionnaire. Discussion is presented under the following section headings: geothermal resources; electric energy conversion; nonelectric uses; recent international developments; environmental considerations, and bibliography. Author (ERA)

N78-32567# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
EFFECTS OF ATMOSPHERIC VARIABILITY ON ENERGY UTILIZATION AND CONSERVATION Final Report, 1 Nov. 1976 - 31 Oct. 1977
Elmar R. Reiter, E. Dreiseitl, G. R. Johnson, H. H. Leong, B. E. MacDonald, W. L. Somervell, Jr., A. M. Starr, and K. O. Timbre Feb. 1978 89 p refs
(Contract EY-76-S-02-1340)
(COO-1340-56) Avail: NTIS HC A05/MF A01

A space-heating energy-consumption model for Greeley, Colorado for the winter of 1976-77 was within 98.9 percent of actual natural gas consumption for that city. Modeling of Cheyenne, Wyoming, including the testing of a new statistical scheme to develop the building census required by the energy consumption model, has progressed to the point where reliable natural gas consumption estimates can be made with the model for that community. A detailed study of temperature and surface wind patterns in and near the city of Greeley, Colorado revealed that, at times, an urban heat island effect is present, in spite of the relatively small size of that town. Various feedback mechanisms between the oceans and the atmosphere were examined. Several of these mechanisms appear to be the cause of the interannual variability of the atmosphere's general circulation and of climatic changes on a time scale of several tens of years. To advance regional long-range forecasting skills January temperature anomalies over the eastern United States were correlated with flow patterns over the U.S. and Canada. ERA

N78-32568# California Univ., Berkeley. Lawrence Berkeley Lab.
ONLY SOURCE OF ENERGY
G. J. Calvin and M. Calvin Mar. 1978 15 p
(Contract W-7405-eng-48)
(LBL-7548) Avail: NTIS HC A02/MF A01

Various plants that might play a role in the energy mix of the future are discussed and illustrated. Included among them are the Euphorbias and Guayule. ERA

N78-32569# Los Alamos Scientific Lab., N. Mex.
SUPERCONDUCTING MAGNETIC ENERGY STORAGE PROJECT AT LASL Progress Report, 1 Jan. - 30 Jun. 1977
W. V. Hassenzahl, comp. Mar. 1978 32 p refs
(Contract W-7405-eng-36)
(LA-7150-PR) Avail: NTIS HC A03/MF A01

Details are reported on part of the design of 10 MWh and 104 MWh Superconducting Magnetic Energy Storage (SMES) units; several superconducting wires were tested; and a study was completed to determine candidate 30 kA conductors that could be made in a modular form and used in large SMES magnets. Ac-dc-ac converters, operating in both symmetric and antisymmetric modes, were tested to determine harmonic content and reactive power requirements. Circuit improvements during this period have reduced the switching time from charge

to discharge, and vice versa, from 20 milliseconds to the theoretical limit of four to seven milliseconds. ERA

N78-32570# Alaska State Div. of Energy and Power Development, Anchorage.
MINIMIZING CONSUMPTION OF EXHAUSTIBLE ENERGY RESOURCES THROUGH COMMUNITY PLANNING AND DESIGN Final Report
Oct. 1977 149 p refs
(Contract EY-76-C-06-2332)
(RLO-2332-1) Avail: NTIS HC A07/MF A01

A study was performed in the State of Alaska and numerous consultants on energy conservation techniques which could be applied to the planning, design, and construction of a new community in the northern climates. This study focused on the minimizing of exhaustible energy resources through planning and design of this new capital city. It was found that the major determinants to energy consumption in a community are the land-use patterns, which affect intracity transportation and utilities distribution, and the built density of the individual homes and buildings which affects heat losses. Configuration of the community also affects the savings that may be realized through the use of district heating and other energy-conserving technologies. ERA

N78-32571# Brookhaven National Lab., Upton, N. Y. Dept. of Nuclear Energy.
POTENTIAL NEED FOR FUSION IN THE US ENERGY SYSTEM
E. Beardsworth and J. Powell Sep. 1977 159 p
(Contract EY-76-C-02-0016)
(BNL-50724) Avail: NTIS HC A08/MF A01

A study was undertaken to examine how and to what degree fusion might be expected to contribute to U.S. energy system, especially as interpreted through a cost benefit analysis, and as it might bear on current research and development decisions. Conditions under which fusion could contribute significantly to long range U.S. energy needs was determined. A methodological frame work which sufficiently and appropriately characterizes the U.S. energy system was developed and key factors that will bear on the need for fusion were identified. B.B.

N78-32572# California Univ., Livermore. Lawrence Livermore Lab.
ENERGY AND TECHNOLOGY REVIEW
H. D. Shay, ed., R. B. Crawford, ed., J. K. Prono, ed., and J. T. Staehle, ed. Oct. 1977 30 p refs
(Contract W-7405-eng-48)
(UCRL-52000-77-10) Avail: NTIS HC A03/MF A01

Topics covered include the following: mirror fusion test facility; developing criteria for the management of nuclear wastes; and a dissector-restorer framing tube for recording very fast experiments. ERA

N78-32573# Oak Ridge National Lab., Tenn. Energy Div.
PERFORMANCE EVALUATION OF A LOW-FIRST-COST, THREE-TON, AIR-TO-AIR HEAT PUMP IN THE HEATING MODE
Albert A. Domingorena 1978 40 p ref Presented at the 3d Ann. Conf. on Heat Pump Technol., Stillwater, Okla., 10-11 Apr. 1978
(Contract W-7405-eng-26)
(CONF-780429-1) Avail: NTIS HC A03/MF A01

The thermal performance of a three-tone, air-to-air heat pump was evaluated in the laboratory under steady-state (no frost) and frosting conditions. In both cases, the heating capacity and the coefficient of performance were computed. During frosting conditions, there was a significant decrease in the outdoor airflow rate through the outdoor coil and this resulted in the decrease in the heating capacity and the coefficient of performance. Results indicate the importance of considering the effect of frost accumulation on the outdoor coil. There may be a significant reduction in thermal performance when the outdoor conditions result in substantial formation of frost on the coil and fins of the outdoor unit. Characteristic curves of both fan-motor units indicate that improvement of the efficiency of the units would reduce the operating costs during the life of the heat pump system with a relatively small increase in the fan-motor unit first cost. ERA

N78-32574# Los Alamos Scientific Lab., N. Mex.
ENERGY SYSTEMS AND STATISTICS Progress Report, Oct. - Dec. 1977
E. A. Snyder, comp. Apr. 1978 29 p refs
(Contract W-7405-eng-36)
(LA-7240-PR) Avail: NTIS HC A03/MF A01

Work was done to display radiometric data from the Lubbock Quadrangle in pseudocolor plots. Procedures were developed and implemented to split previously sampled areas into 1 deg by 2 deg map sheet areas in support of the Hydrogeochemical and Stream Sediment Reconnaissance Project. Data in the new data base, OIL3, were reviewed and missing and erroneous data entries reported to the Geological Survey. Hardware specifications were developed for a stand-alone/distributed-processing graphics terminal. A method for measuring the sensitivity of an output to a group of inputs taken collectively was implemented in the Transient reactor analysis code. In reviewing documents on the line of assurance approach to reactor safety, the probability model underlying the new approach was analyzed. ERA

N78-32575# Institute for Energy Analysis, Oak Ridge, Tenn.
ENERGY INTERDEPENDENCE: TODAY AND TOMORROW
J. N. Barkenbus Apr. 1978 35 p refs
(Contract EY-76-C-05-0033)
(ORAU/IEA(O)-78-3) Avail: NTIS HC A03/MF A01

The current fossil fuel era, differs substantially from the wood-based energy system: large institutions are now responsible for satisfying the consumer's energy needs; long distances often separate resource exploitation from resource consumption; and governments now play. The finite nature of fossil fuel resources has created a precarious network of global energy trade and led to serious vulnerabilities within the industrial nations. Future energy systems, based upon nuclear and solar technologies, will make use of fuels which, unlike fossil fuels, are abundant and ubiquitous. An energy future free from the limitations and vulnerabilities associated with the fossil fuel era is envisioned. For numerous reasons, however, utilization of these technologies--over the next half century or so--will require interaction among nations. As a consequence, energy interdependence, rather than national energy independence, is likely to predominate well into the twenty-first century. ERA

N78-32576# Institute for Energy Analysis, Oak Ridge, Tenn.
SERVICES AND ENERGY IN U.S. ECONOMIC GROWTH
R. W. Gilmer Dec. 1977 59 p refs
(Contract EY-76-C-05-0033)
(ORAU/IEA(M)-77-33) Avail: NTIS HC A04/MF A01

It is often argued that, as economic growth proceeds, service industries will inexorably displace basic manufacturing. If true, and if it is accepted that goods production requires less energy than services, the result will be a decline in energy needs resulting strictly from a secular readjustment of consumption. It was found that such projections are generally over-optimistic; energy savings from structural changes in consumption are probably small in contrast to the kinds of savings that result from policies designed to promote conservation by legal or institutional change or through price incentives. This failure results in part from serious problems concerning productivity and cost escalation in service industries. And it results in part from the dependence of services on sectors using high levels of energy; the total requirements for energy by services, including those requirements they impose on their suppliers, limits the range of potential savings from service-sector growth. Numerical estimates and projections are developed from 1975 to 2000. ERA

N78-32577# Department of Energy, Washington, D. C.
ENERGY IMPACT ASSISTANCE: REPORT TO THE PRESIDENT
Mar. 1978 139 p
(DOE/IR-0009) Avail: NTIS HC A07/MF A01

Topics covered include: (1) the nature of the adverse socio-economic impacts from large new energy development projects now occurring and which are likely to occur in the future as domestic resources are developed; (2) the degree to which Federal, state, local, and private programs and efforts are meeting the current needs of communities impacted by energy development and the degree to which they are capable of meeting

anticipated needs; and (3) set forth, for the President's decision, possible approaches that might be taken at the Federal level to provide additional assistance to communities that now experience, or may experience in the future, adverse impacts as a result of large new energy developments. The nature of energy development related growth is discussed along with the needs that energy-development-impacted communities are currently experiencing in five areas: public facilities and services, commercial facilities and professional services, housing, social and cultural needs, and transportation. ERA

N78-32578# Argonne National Lab., Ill.
COMMUNITY SYSTEMS PROGRAM: ITS GOALS AND ACCOMPLISHMENTS, 1978
Apr. 1978 33 p
(Contract W-31-109-eng-38)
(ANL-78-XX-92) Avail: NTIS HC A03/MF A01

The Community Systems Program is concerned with conserving energy and scarce fuels through new methods of satisfying the energy needs of American communities. These programs are designed to develop innovative ways of combining current, emerging, and advanced technologies into Integrated Community Energy Systems (ICES) that could furnish any, or all, of the energy-using services of a community. The key goals of the Community System Program then, are to identify, evaluate, develop, demonstrate, and deploy energy systems and community designs that will optimally meet the needs of various communities. During 1977, contracts for the following Grid-Connected ICES (G-C ICES) demonstration teams were negotiated: City of Independence, Missouri; Clark University; City of Trenton, New Jersey; Health Education Authority of Louisiana (HEAL); and University of Minnesota. A coal-using ICES, proposed for Georgetown University, also has made noticeable strides toward demonstration of the concept. ERA

N78-32579# Westinghouse Research and Development Center, Pittsburgh, Pa. Research and Development Center.
REGIONAL CONCEPTUAL DESIGN AND ANALYSIS STUDIES FOR RESIDENTIAL PHOTOVOLTAIC SYSTEMS Interim Report
P. F. Pittman, E. F. Federmann, R. W. Stoeltzing, W. J. McAllister, P. R. Rittlemann, and S. Nearhoof Apr. 1978 147 p
(Contract EY-76-C-04-0789)
(SAND-78-7014) Avail: NTIS HC A07/MF A01

This preliminary report deals with the methodology of selecting superior on-site photovoltaic total energy residential systems that could apply to most regions of the United States. Selection of sites representing these regions, typical insolation and residential electrical and thermal loads for these sites, and the means of utilizing these data to select the superior systems for each region are reviewed. This entails acquisition of the best available insolation data for the sites selected and analysis of this data to determine a typical year for each site so that hour-by-hour computer analysis can be limited to one year for determination of the lifetime benefit of the system. A further requirement is the determination of electrical and thermal loads for each site so that the match of solar energy converted by the various solar energy systems to the residential load can be made and the solar displacement can be computed. Three levels of screening are used to systematically eliminate those systems which offer less potential than the eventual superior systems. ERA

N78-32580# Department of Energy, Washington, D. C.
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION'S (ERDA) MATERIALS COORDINATING COMMITTEE (EMACC) Annual Report, FY 1977
Feb. 1978 54 p
(DOE/ET-0011) Avail: NTIS HC A04/MF A01

A set of program summaries from member divisions of the ERDA Materials Coordinating Committee are presented for all divisions except solar energy, procurement, Biological and environmental research, and environmental control technology. The materials R and D budgets in FY 1977 for the divisions that contributed to the report are summarized. ERA

N78-32581# Los Alamos Scientific Lab., N. Mex.
SOLAR ENERGY RESEARCH AT LASL Progress Report, 1 Jul. 1976 - 30 Sep. 1977
C. A. Bankston, comp. and D. A. Neeper, comp. Apr. 1978 116 p refs
(Contract W-7405-eng-36)
(LA-7115-PR) Avail: NTIS HC A06/MF A01

The work of the solar energy group (Q-11) during the period July 1976 through September 1977 is reported. The group provided technical support to ERDA, performed research on solar collectors, and carried out systems studies on both active and passive systems. In addition, significant accomplishments occurred in the group's solar air conditioning and mobile/modular solar home projects. ERA

N78-32582# Sandia Labs., Livermore, Calif. Solar Project Div.
ISSUES AND METHODOLOGY FOR THE SELECTION OF A CONCEPTUAL DESIGN FOR A SOLAR CENTRAL RECEIVER PILOT PLANT
A. C. Skinrood 1978 14 p refs Presented at Symp. on Solar-Thermal Power Stations, Cologne, 12 Apr. 1978
(Contract EY-76-C-04-0789)
(SAND-77-8763; Conf-780425-2) Avail: NTIS HC A02/MF A01

The selection process developed to recommend a conceptual design for the solar central receiver pilot plant to be built at Barstow, California is described. Included are the key selection issues and their significance. ERA

N78-32583# Department of Energy, Washington, D. C.
REPORT TO THE PRESIDENT AND THE CONGRESS ON THE STATE ENERGY CONSERVATION PROGRAM Annual Report
Dec. 1977 130 p
(DOE/CS-0019/1) Avail: NTIS HC A07/MF A01

The State Energy Conservation Program was established on December 22, 1975 by the Energy Policy and Conservation Act. The program provided a means by which a State may voluntarily enter into a cooperative effort with the Federal government to further that State's energy conservation efforts. Under the program, each State bore the responsibility for developing and implementing a comprehensive State energy conservation plan. The Federal government, in turn, provided both technical assistance and financial support. Eligibility was extended to all 50 States, the District of Columbia, Puerto Rico, Guam, American Samoa, the Virgin Islands, and the Trust Territory of the Pacific - a total of 56 jurisdications. Fifty-five of the 56 jurisdictions were participating. The program goal was to reduce the energy consumption within each participating jurisdiction by 5 percent or more annually by 1980. ERA

N78-32584# California Univ., Livermore. Lawrence Livermore Lab.
ENVIRONMENTAL GEOLOGY WORKSHOP FOR THE GEYSERS-CALISTOGA KNOWN GEOTHERMAL RESOURCES AREA
Gene Ledbetter and Neil B. Crow 8 Feb. 1978 13 p Workshop held at Sonoma, Calif., 28-29 Nov. 1977
(Contract W-7405-eng-48)
(UCRL-52418) Avail: NTIS HC A02/MF A01

The study included the effects of development on air and water quality, geology, the ecosystem, socioeconomics, and noise. The Geothermal Resource Impact Projection Study (GRIPS) has grants to undertake similar work. On 28 and 29 November 1977, LLL and GRIPS jointly sponsored a workshop at Sonoma State College at which earth scientists presented their views on the potential geological hazards of geothermal development. The workshop produced recommendations for studies in geological mapping, slope stability, subsidence, seismicity, and groundwater hydrology. ERA

N78-32585# National Technical Information Service, Springfield, Va.
ENERGY CONSERVATION: INDUSTRY. A BIBLIOGRAPHY WITH ABSTRACTS Final Report, 1964 - May 1978
Audrey S. Hundemann Jun. 1978 229 p Supersedes NTIS/PS-77/0505; NTIS/PS-76/0404;
(NTIS/PS-78/0570/8; NTIS/PS-77/0505; NTIS/PS-76/0404)
Avail: NTIS HC $28.00/MF $28.00 CSCL 10A

Potential methods of conserving energy, including fuel and

materials substitutions, are considered for various industries. Many abstracts deal with reports that also cover processes used, amount of energy consumed, and environmental considerations of energy conserving options. Industries covered include food, paper, chemical, cement, metals, petroleum refining, contract construction, synthetic rubber, plastic, drug manufacturing, and stone, clay, and glass. Energy conservation through the use of waste heat is covered in a related published search entitled Waste Heat Utilization. GRA

N78-32586# National Technical Information Service, Springfield, Va.

ENERGY SUPPLY AND DEMAND MODELING. A BIBLIOGRAPHY WITH ABSTRACTS Final Report, 1964 - May 1978

Audrey S. Hundemann Jun. 1978 99 p
(NTIS/PS-78/0599/7) Avail: NTIS HC $28.00/MF $28.00 CSCL 10A

This bibliography contains 94 abstracts. The use of energy models to estimate the supply and demand of electricity, oil, natural gas, coal, and petroleum products on national, regional, and state levels is discussed. The models cover residential, commercial, and industrial supply and demand; the impact of economic conditions on demand; energy use alternatives; and optimal allocation of regionally produced energy resources. Abstracts pertaining to design and development of energy models are included. GRA

N78-32587# National Technical Information Service, Springfield, Va.

NICKEL CADMIUM BATTERIES. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1970 - Jun. 1978

Mona F. Smith Jun. 1978 293 p Supersedes NTIS/PS-77/0555; NTIS/PS-76/0466; NTIS/PS-75/445
(NTIS/PS-78/0618/5; NTIS/PS-77/0555; NTIS/PS-76/0466; NTIS/PS-75/445) Avail: NTIS HC $28.00/MF $28.00 CSCL 10C

The design, fabrication, components, testing, and assembly of nickel cadmium batteries are covered. The majority of these citations deal with the development of power supplies for aircraft and spacecraft. (This updated bibliography contains 288 abstracts, 30 of which are new entries to the previous edition.) GRA

N78-32588# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.

INVESTMENT IN COMMERCIAL DEVELOPMENT OF OCEAN THERMAL ENERGY CONVERSION (OTEC) PLANT-SHIPS Final Report, Sep. 1976 - Aug. 1977

E. J. Francis Dec. 1977 227 p refs
(Contract MA-5-38054)
(PB-280922/6; APL/JHU/SR-77-3; MA-RD-920-78038) Avail: NTIS HC A11/MF A01 CSCL 07A

The use of ocean thermal energy conversion (OTEC) as an alternative to fossil fuels and nuclear power is discussed. In addition to initial use of OTEC ammonia for production of fertilizers and industrial chemicals, OTEC ammonia can be used as a hydrogen carrier for production of electricity. Economic recommendations and analysis are given. GRA

N78-32589# Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.

INTEGRATED INVENTORIES OF RENEWABLE NATURAL RESOURCES

H. Gyde Lund (Bureau of Land Management, Denver), Vernon J. Labau, Peter F. Ffolliott (Arizona Univ., Tucson), and David W. Robinson (Oklahoma State Univ., Stillwater) 1978 493 p refs Workshop held at Tucson, Ariz., 8-12 Jan. 1978; sponsored by Soc. of Am. Foresters, Arizona Univ., US Forest Service, Dept. of Interior, and Renewable Natural Resources Foundation
(PB-281036/4; FSGTR/RM-55) Avail: NTIS HC A20/MF A01 CSCL 10A

Efficient, objective, and timely inventory systems through integrated inventories are presented in 82 papers. Included are papers covering: information requirements, current techniques, need for integrating inventories, land classification systems, remote sensing, principles for integrating inventories, data processing, information systems, and state of the art. GRA

N78-32590# Bureau of Mines, Pittsburgh, Pa. Eastern Field Operation Center.

PROJECTS TO EXPAND FUEL SOURCES IN EASTERN STATES: SURVEY OF PLANNED OR PROPOSED COAL MINES, COAL AND NONCOAL CONVERSION PLANTS, ELECTRIC GENERATING PLANTS OIL REFINERIES, URANIUM ENRICHMENT FACILITIES, AND RELATED INFRASTRUCTURE, IN STATES EAST OF THE MISSISSIPPI RIVER Final Report, period ending 31 Jul. 1977

David C. Benson and Frank J. Doyle Aug. 1977 153 p
(PB-281249/3; BM-IC-8765) Avail: NTIS HC A08/MF A01 CSCL 10A

Tables listing the name, location, and other pertinent data concerning future energy related projects are presented. The tables include information on projects involving the proposed or planned development of fuel resources, as well as the development of storage, transportation, and conversion facilities; the report covers the 26 States east of the Mississippi River Of the total 535 projects for which information is provided, 429 concern coal mines and electric generating plants. GRA

N78-32591# National Technical Information Service, Springfield, Va.

FUEL CELLS, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1974 - 1976

Diane M. Cavagnaro Jul. 1978 205 p
(NTIS/PS-78/0632/6) Avail: NTIS HC $28.00/MF $28.00 CSCL 10B

This bibliography contains 200 abstracts dealing with fuel cell applications, components, fabrication, design, catalysts, and chemistry. Hydrogen oxygen cells, hydrocarbon air cells, and biochemical cells are covered. GRA

N78-32592# National Technical Information Service, Springfield, Va.

FUEL CELLS, VOLUME 3. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1977 - Jun. 1978

Diane M. Cavagnaro Jun. 1978 143 p Supersedes NTIS/PS-77/0544; NTIS/PS-76/0507; NTIS/PS-75/479; COM-74-11533
(NTIS/PS-78/0633/4; NTIS/PS-77/0544; NTIS/PS-76/0507; NTIS/PS-75/479; COM-74-11533) Avail: NTIS HC $28.00/MF $28.00 CSCL 10B

This bibliography contains 138 abstracts. Fuel cell applications, components, fabrication, design, catalysts, and chemistry are covered. Hydrogen oxygen cells, hydrocarbon air cells, and biochemical cells are included. GRA

N78-32593# National Technical Information Service, Springfield, Va.

HYDROCARBON FUEL CELLS. CITATIONS FROM THE AMERICAN PETROLEUM INSTITUTE DATA BASE Progress Report, 1967 - Apr. 1978

Diane M. Cavagnaro Jul. 1978 137 p
(NTIS/PS-78/0651/6) Avail: NTIS HC $28.00/MF $28.00 CSCL 10B

This bibliography presents 126 abstracts on worldwide research on hydrocarbon fuel cells. The citations cover their application, design, performance, fabrication, catalysts, and electrochemistry. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N78-32594 Denver Univ., Colo.

MONITORING OF ATMOSPHERIC NITRIC ACID AND FLUOROCARBON-11 BY MEANS OF GROUND-BASED SOLAR SPECTROSCOPY Ph.D. Thesis

Charles Marion Bradford 1978 99 p
Avail: Univ. Microfilms Order No. 7812863

Observations made by using high resolution infrared solar spectroscopy are presented. The technique requires large zenith angles in order to obtain sufficient absorption for quantification and has the advantage that local contamination is not a significant problem. Observations over a period of time and at two different

altitudes indicate that fluorocarbon-11 is essentially tropospheric and uniformly mixed. Conversely, nitric acid is mostly stratospheric and layered. Seasonal variation in nitric acid is also observed. Typical spectra and vertical column densities of nitric acid and fluorocarbon-11 are presented. Dissert. Abstr.

N78-32595 Oregon State Univ., Corvallis.
INPUT/OUTPUT ENERGY ANALYSIS OF REGIONAL WATER POLLUTION CONTROL Ph.D. Thesis
Richard John Heggen 1978 230 p
Avail: Univ. Microfilms Order No. 7811983

Approaches to environmental control for Oregon's Willamette River are examined. One is that of current enforcement coupled with present levels of augmentation. Another consists of less augmentation and increased wastewater treatment. The third approach consists of increased flow augmentation for water quality control. Each alternative of environmental control is evaluated as if it had been practiced in a study year of low natural runoff. The relation of augmentation for water quality to other river uses is used to value flow in a benefits-foregone manner. Independently, reservoir costs are allocated to water quality. An instream unit price is assigned to augmentation. For each alternative of treatment and augmentation, the dissolved oxygen quality of the Willamette is simulated and the costs of the environmental strategy estimated. River quality, dollar costs, and energy impact response surfaces are developed. Dissert. Abstr.

N78-32596*# Aerospace Corp., El Segundo, Calif.
AIRCRAFT HO SUB x AND NO SUB x EMISSION EFFECTS ON STRATOSPHERIC OZONE AND TEMPERATURE
L. Glatt and G. F. Widhopf Sep. 1978 72 p refs
(Contract NAS1-13970)
(NASA-CR-158945) Avail: NTIS HC A04/MF A01 CSCL 13B

A simplified two-dimensional steady-state photochemical model of the atmosphere was developed. The model was used to study the effect on the thermal and chemical structure of the atmosphere of two types of pollution cases: (1) injection of NOx and HOx from a hypothetical fleet of supersonic and subsonic aircraft and (2) injection of HOx from a hypothetical fleet of liquid-fueled hydrogen aircraft. The results are discussed with regard to stratospheric perturbations in ozone, water vapor and temperature. S.B.S.

N78-32597*# National Aeronautics and Space Administration, Washington, D. C.
RESULTS OF THE MEASUREMENT OF ATMOSPHERIC OZONE AND HYDROCARBONS IN BADEN-WURTTEMBURG
W. Blander and D. Siegel Aug. 1978 13 p refs Transl. into ENGLISH from VDI-Berichte (West Germany), no. 270, 22-24 Sep. 1977 p 57-61 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Baden-Wurttemberg Regional Agency for Environ. Protect., Karlsruhe, West Germany
(Contract NASw-3199)
(NASA-TM-75332) Avail: NTIS HC A02/MF A01 CSCL 13B

Data are presented on the diurnal variations of the levels of ozone, ethylene, ethane, and acetylene. The measurement procedures used are described. Variations in monthly ozone levels are given, and measurements from different stations are compared. Data on the total monthly concentrations of NO and NO2 are compared with similar data for ozone. Problems in determining interrelationships among the concentrations of the various substances are discussed. S.B.S.

N78-32598# Panametrics, Inc., Waltham, Mass.
RADIATION INDUCED PARTICULATE AGGLOMERATION FEASIBILITY STUDY Progress Report, 31 Mar. 1977 - 31 Mar. 1978
Bach Sellers, Frederick A. Hanser, and Lee W. Parker Apr. 1978 60 p refs Prepared in cooperation with Lee W. Parker, Inc., Concord, Mass., for Harvard Univ., Boston, Mass.
(AD-A055860; PANA-RIPA-1) Avail: NTIS HC A04/MF A01 CSCL 20/8

The removal of aerosol particles from a gas by standard gas filtration techniques is more difficult for submicron particles than for larger particles. Filtration methods presently in use can achieve high efficiencies of submicron particle removal by use of high-efficiency HEPA filters. The system investigated is intended to agglomerate fine particles into larger sizes so that they are more easily captured by inexpensive low-efficiency prefilters used ahead of the more expensive HEPA filters. The basic concept involves use of a beta radiation source to generate an intense volume of ionization. Application of an electric field to plates enclosing this volume then produces separate regions of positive and negative ions through which the particulate-containing air passes. After leaving this charging stage the oppositely-charged particulate distributions enter an agglomeration stage in which the polarity on the enclosing plates is reversed, so that particles of opposite sign are brought into close proximity, hence producing agglomeration and shifting the particle distribution toward larger sizes. With 20 kV on the plates, the charging times can be on the order of one second or less. GRA

N78-32599# Army Construction Engineering Research Lab., Champaign, Ill.
POLLUTION ABATEMENT MANAGEMENT SYSTEM: CONCEPT DEFINITION Final Report
Ronald D. Webster, E. D. Smith, and V. Kothandaraman May 1978 69 p refs
(DA Proj. 4A7-62620-A-896)
(AD-A055565; CERL-TR-N-42) Avail: NTIS HC A04/MF A01 CSCL 13/2

Regulatory and legislative requirements of Federal and state pollution control acts such as Public Law 92-500, the Clean Air Act, and the Solid Waste Management Act require Army installations to constrain the effluents of their operations within prescribed limits of quality. The Pollution Abatement Management System (PAMS) will help the facility engineer, Army Major Commands (MACOMs), and headquarters environmental offices implement these requirements by providing manual and computer-assisted procedures to (1) determine the most cost-effective, site applicable, energy-conservative solutions for bringing air, water, and solid waste emissions from Army operations into compliance with Federal, state, and Army standards using existing technology and commercial developments wherever possible; (2) monitor the scheduled progress in meeting those prescribed Federal, state, and Army standards; and (3) identify priority ranking of environmental pollution problems within the Department of the Army. This report formalizes the overall concept development of PAMS and the system's developmental strategy. GRA

N78-32600# Columbia Univ., New York.
METHODOLOGICAL PROBLEMS ARISING FROM THE CHOICE OF AN INDEPENDENT VARIABLE IN LINEAR REGRESSION, WITH APPLICATION TO AN AIR POLLUTION EPIDEMIOLOGICAL STUDY
Inge F. Goldstein, Martin Goldstein (Yeshiva Univ.), Joseph L. Fleiss, and Leon Landovitz (City Univ. of New York) 1977 16 p refs
(Contract EY-76-S-02-2874)
(COO-2874-28) Avail: NTIS HC A02/MF A01

In epidemiological studies using linear regression, it is often necessary for reasons of economy or unavailability of data to use as the independent variable not the variable ideally demanded by the hypothesis under study but some convenient practical approximation to it. If the correlation coefficient between the practical and ideal variables can be obtained, then a range of uncertainty can be obtained within which the desired regression coefficient of dependent on ideal variable may lie. These points are illustrated with data and observed regression coefficients from an air pollution epidemiological study, in which pollution measured at one station in a large metropolitan area was used as the practical approximation to the city-wide average pollution. The uncertainties in the regression coefficients were found to exceed the regression coefficients themselves by factors of 15 to 150. ERA

N78-32601# California Univ., Livermore. Lawrence Livermore Lab.
THE HIGH ALTITUDE POLLUTION PROGRAM Annual Report, 1977
F. M. Luther 30 Sep. 1977 102 p refs
(Contract W-7405-eng-48)
(UCRL-50042-77) Avail: NTIS HC A06/MF A01

The High Altitude Pollution Program (HAPP) was initiated

by the Federal Aviation Administration to ensure that aircraft engine emissions in the stratosphere will not result in unacceptable effects on the biosphere. Lawrence Livermore Laboratory (LLL) has participated in HAPP since July 1975. The primary research emphasis at LLL is on numerical modeling of the atmospheric response to stratospheric perturbations. The modeling effort at LLL covers four major research areas: photochemical kinetics, coupled kinetics and transport, radiative transfer, and meteorological analysis. Progress since July 1, 1976 is reported. ERA

N78-32602# National Technical Information Service, Springfield, Va.
METAL PROCESSING WASTES. PART 1: AIR POLLUTION. VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1976 - May 1978
Diane M. Cavagnaro May 1978 172 p Supersedes NTIS/PS-77/0448; NTIS/PS-76/0384; NTIS/PS-75/383
(NTIS/PS-78/0504/7; NTIS/PS-77/0448; NTIS/PS-76/0384; NTIS/PS-75/383) Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

The bibliography is the second volume on air pollution from metal processing and cites control, quantity, economics and health aspects. The citations cover broad industry studies as well as the analysis of problems of specific industrial plants and processes. The emphasis is on refining, smelting, casting, and metal working for the iron and steel, aluminum, copper, chromium, zinc, and other metal industries. GRA

N78-32603# National Technical Information Service, Springfield, Va.
METAL PROCESSING WASTES. PART 2: WATER POLLUTION. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1970 - May 1978
Diane M. Cavagnaro May 1978 231 p Supersedes NTIS/PS-77/0449; NTIS/PS-76/0385; and NTIS/PS-75/382
(NTIS/PS-78/0505/4; NTIS/PS-77/0449; NTIS/PS-76/0385; NTIS/PS-75/382) Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

Water pollution control, processes, abatement planning, economics, quantity, and health effects from metal processing is covered in this bibliography on metal refining, smelting, working, and finishing. GRA

N78-32604# National Technical Information Service, Springfield, Va.
AIR POLLUTION EMISSION FACTORS: A BIBLIOGRAPHY WITH ABSTRACTS Final Report, 1964 - May 1978
Diane M. Cavagnaro Jun. 1978 138 p Supersedes NTIS/PS-77/0489; NTIS/PS-76/0392; NTIS/PS-75/410
(NTIS/PS-78/0548/4; NTIS/PS-77/0489; NTIS/PS-76/0392; NTIS/PS-75/410) Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

Emission factors for various industry, stationary, and mobile sources are presented in this annotated bibliography of research reports. The calculation and use of these factors are included. GRA

N78-32605# National Technical Information Service, Springfield, Va.
ATMOSPHERIC MODELING OF AIR POLLUTION, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1974-1976
Diane M. Cavagnaro Jun. 1978 168 p refs
(NTIS/PS-78/0630/0) Avail: NTIS HC $28.00/MF $28.00 CSCL 04B

This updated bibliography contains 163 abstracts. Topics covered include: lower atmospheric modeling of air pollution from both mobile and stationary sources; local and worldwide diffusion; urban heat islands; precipitation washout; climatology; and smog. GRA

N78-32606# National Technical Information Service, Springfield, Va.
ATMOSPHERIC MODELING OF AIR POLLUTION, VOLUME 3. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1977 - Jun. 1978
Diane M. Cavagnaro Jun. 1978 178 p Supersedes NTIS/PS-77/0566; NTIS/PS-76/0509; NTIS/PS-75/476
(NTIS/PS-78/0631/8; NTIS/PS-77/0566; NTIS/PS-76/0509; NTIS/PS-75/476) Avail: NTIS HC $28.00/MF $28.00 CSCL 04B

This updated bibliography contains 173 abstracts. Lower atmospheric modeling of air pollution from both mobile and stationary sources are covered. Local diffusion, urban heat islands, precipitation washout, worldwide diffusion, climatology, and smog are among the topics included. GRA

N78-32607# Governors State Univ., Park Forest South, Ill. Environmental Management Program.
A GUIDE TO ENVIRONMENTAL BENEFITS ASSESSMENT IN ECONOMIC IMPACT STUDIES Final Report
Howard A. Roberts and Herman Sievering Apr. 1978 463 p refs
(PB-280687/5; IIEQ-77/32) Avail: NTIS HC A20/MF A01 CSCL 05C

The intent of the guide is to provide an overview of the field of environmental benefits assessment and to suggest a framework for the conduction of the assessment in relation to the economic impact studies called for in Illinois Public Act 79-790. (Assessment of environmental costs due to increased pollution relies on the same principles and methods.) GRA

N78-32608# Equitable Environmental, Inc., Park Ridge, Ill.
ECONOMIC IMPACT OF RELAXING THE REGULATION ON SULFUR CONTENT OF FUEL OILS (R75-8) Final Report
Apr. 1978 195 p refs Sponsored by Illinois Inst. for Environmental Quality
(PB-280974/7; IIEQ-77/30) Avail: NTIS HC A09/MF A01 CSCL 05C

As a consequence of enacting the proposed regulation, ambient sulfur dioxide levels in Illinois would increase. No violations of the standards would be caused by enacting the proposed regulation; however, several existing violations were recorded in the state. No environmental benefits would result from the proposed regulation. Environmental costs investigated were health, ecological and materials costs. Enacting the proposed regulation would not, of itself, result in a cost-savings benefit; rather, fuel oil costs might then vary only as a function of natural market place forces. On the other hand, it seems certain that, if the current regulations were maintained, the result would be increases in the cost of both fuel oil and the goods and services of fuel oil users. L.S.

N78-32609# Illinois Inst. for Environmental Quality, Chicago.
MORTON GROVE LEAD STUDY: AN INVESTIGATION OF THE CONTRIBUTION OF AIRBORNE LEAD FROM AUTOMOBILE EXHAUST TO BLOOD LEAD LEVELS IN SUBURBAN CHILDREN Final Report
Sally J. Jansen, Bertram W. Carnow, and Tsukasa Namekata Apr. 1978 73 p refs
(PB-280717/0; IIEQ-77/13) Avail: NTIS HC A04/MF A01 CSCL 06E

Results suggest that airborne lead from autos using heavily traveled roadways may contribute to the blood lead levels of children, especially to that of preschool children. Because of these findings, it is recommended that baffles, such as trees, be utilized along major roadways passing through populated areas. Children residing along such roadways should receive instruction in hygiene so they understand the importance and reason for keeping non-food items out of their mouths and for frequent and thorough handwashing. GRA

N78-32610# Monsanto Research Corp., Dayton, Ohio.
SOURCE ASSESSMENT: MAJOR BARIUM CHEMICALS Final Report
R. B. Rezink and H. D. Troy, Jr. Mar. 1978 154 p refs
(Contract EPA-68-02-1874)
(PB-280756/8; EPA-600/2-78-004b) Avail: NTIS HC A08/MF A01 CSCL 07A

The data on air emissions from the production of major barium chemicals is summarized. Compounds studied include barium sulfide, barium carbonate, barium chloride, barium hydroxide, and barium sulfate. In order to evaluate potential environmental effects the source severity, S, was calculated for each emission species from each emission point. Various control devices are used to reduce emissions. Scrubbers and baghouses

are used on the black ash rotary kiln and on product dryers and calciners. A scrubber and an electrostatic precipitator are employed to control the exhaust from the barium hydroxide process. GRA

N78-32611# Automotive Testing Labs., Inc., Aurora, Colo.
STUDY OF EXHAUST EMISSIONS FROM 1966 THROUGH 1976 MODEL-YEAR LIGHT-DUTY VEHICLES IN DENVER, CHICAGO, HOUSTON AND PHOENIX
Douglas R. Liljedahl and Jerry L. Terry Aug. 1977 803 p
(Contract EPA-68-03-2378)
(PB-280725/3; EPA-460/3-77-005) Avail: NTIS HC A99/MF A01 CSCL 13B

Emission tests were performed on a sample of light-duty vehicles operating in the Chicago, Houston, Phoenix and Denver metropolitan areas. These tests were performed for the determination of light-duty vehicle emission factors. All vehicles were tested in the as-received condition by the Federal Test Procedure. Other tests are included and were also performed under the Federal Test Procedure. GRA

N78-32612# Argonne National Lab., Ill.
OXYGEN ISOTOPES IN ATMOSPHERIC SULFATES, SULFUR DIOXIDE, AND WATER VAPORS FIELD MEASUREMENTS, JULY 1975 Final Report, May 1976 - May 1977
B. Holt, M. Bouchard, P. Cunningham, A. Engelkemeir, and E. Nielsen Apr. 1978 34 p refs
(Contract EPA-IAG-D6-F024)
(PB-281014/1; EPA-600/3-78-045) Avail: NTIS HC A03/MF A01 CSCL 07D

Oxygen isotope ratios were determined for atmospheric samples of sulfate aerosols, sulfur dioxide, and water vapor collected simultaneously during a six-day period in July, 1975, at St. Louis, Mo.; Auburn, Ill., and Glasgow, Il. The collection sites were located about 100 km apart. Concerted variations in isotopic and concentration results were found for the three sites, demonstrating an apparent regional impact on the quality and quantity of particulate sulfate in the atmosphere. At all three sites, the oxygen-18 enrichments in suspended sulfates clearly varied inversely with sulfate concentration. Samples collected during a period of local thunderstorm activity showed an abrupt increase in the oxygen-18 composition of particulate sulfate, but little effect on the isotopic composition of ambient water vapor. GRA

N78-32613# Texas Univ. at Austin. Dept. of Chemical Engineering.
DYNAMICS OF AUTOMOTIVE SULFATE EMISSIONS Interim Report, Nov. 1976 - Nov. 1977
S. H. Suck, K. DeBower, and J. R. Brock Apr. 1978 56 p refs
(Grant EPA-R-803660)
(PB-280559/6; EPA-600/3-78-043) Avail: NTIS HC A04/MF A01 CSCL 13B

An assessment of the potential environmental impact of automotive sulfuric acid (or sulfate) aerosol was made by analyzing the aerosol dynamics. This analysis lead to a prediction of ambient automotive sulfuric acid aerosol concentrations over and around a large, ten-lane highway with most cars having catalytic converters. The attachment rate of fine automotive sulfuric acid aerosols to ambient aerosols was examined. The dispersion and deposition of automotive sulfate was modelled over the highway for 'worst case' meteorology. The neutralizing effect of ambient ammonia on sulfuric acid concentrations around the highway was examimed by a direct simulation procedure for dispersion calculations. GRA

N78-32614# Tracor Jitco, Inc., Rockville, Md.
PROCEDURE FOR THE EVALUATION OF ENVIRONMENTAL MONITORING LABORATORIES Technical Report, 10 Jan. 1975 - 10 Jan. 1976
Charles A. Bicking Mar. 1978 227 p refs
(Contract EPA-68-03-2171)
(PB-280718/8; EPA-600/4-78-017) Avail: NTIS HC A11/MF A01 CSCL 13B

A procedure was developed for the on-site evaluation of environmental laboratories in such media as air, water, radiation and pesticides. The procedure includes registration and preliminary questionnaire forms, on-site visits checklist, evaluator's guide and a scoring system for assessemnt of the laboratory's management, personnel, facilities, analytical methodology and instruments and it quality control procedures. GRA

N78-32615# Monsanto Research Corp., Dayton, Ohio.
SOURCE ASSESSMENT: PLASTICS PROCESSING, STATE-OF-THE-ART Final Report, Dec. 1974 - Jul. 1977
T. W. Hughes, R. F. Boland, and G. M. Rinaldi Mar. 1978 106 p refs
(Contract EPA-68-02-1874)
(PB-280926/7; MRC-DA-705; EPA-600/2-78-004c) Avail: NTIS HC A06/MF A01 CSCL 11I

The state of the art of air emissions from plants that manufacture marketable products via plastics processing is reviewed. The composition, quantity, rate of emissions, and control technology are described. To assess the severity of emissions from this industry, a representative plant was defined for each of the 16 plastic types based on the results of this study. Source severity was defined as the ratio of the maximum time-averaged ground level concentration of a pollutant to the primary ambient air quality standard for criteria pollutants. Hydrocarbon source severities ranged from 4.2 to 98 for polyacetal and polyurethane manufacture, respectively. Source severities for particulates are also calculated. Plastics processing contributes 2.8% of the national hydrocarbon emissions and 0.12% of the national particulate emissions. GRA

N78-32616# Rutgers - The State Univ., New Brunswick, N. J. Dept. of Chemical and Biochemical Engineering.
OIL/WATER SEPARATION: STATE-OF-THE-ART Final Report, 11 Jul. 1975 - 31 Jul. 1977
Fidelis A. Osamor and Robert C. Ahlert Apr. 1978 105 p refs
(Grant EPA-R-803978)
(PB-280755/0; EPA-600/2-78-069) Avail: NTIS HC A06/MF A01 CSCL 14B

Devices and process are classified according to the primary mechanism that induces separation of oil/water mixtures. The basic concepts, specific design features, operational conditions, and limitations of each category are discussed. Literature on test evaluation of a variety of devices is critiqued on the basis of actual or potential success in treating various oil/water system states. No single technique can separate all oil/water system states efficiently. Specific deficiencies in existing technology are identified. GRA

N78-32617# Worcester Polytechnic Inst., Mass.
COMBINED EFFECT OF THERMAL AND ORGANIC POLLUTION ON OXYGEN SAG CURVE, PHASE 2 Final Report
K. Keshavan and G. C. Sornberger 1978 94 p refs
(Contract DI-14-31-0001-9014)
(PB-281034/9; W78-06751; OWRT-C-4067(9014)(1)) Avail: NTIS HC A05/MF A01 CSCL 13B

A Monte Carlo computer simulation of the estuarine dynamics of BOD motion and decomposition was developed subject to the effects of longitudinal dispersion, fresh water flow, cyclic tidal flow, and thermal overload. Sample travel patterns and BOD decomposition profiles were obtained under varying sets of initial conditions with the results displayed both graphically and in tabular form. The interpretation of the underlying stochastic model and the Monte Carlo simulated travel patterns is discussed and the applicability of the method to water quality management is indicated. GRA

N78-32618# Research Triangle Inst., Research Triangle Park, N. C.
OPTIMUM METEOROLOGICAL AND AIR POLLUTION SAMPLING NETWORK SELECTION IN URBAN AREAS Final Report
Fred M. Vukovich, Walter D. Bach, Jr., and C. Andrew Clayton Dec. 1977 129 p refs Sponsored in part by EPA
(Grant NSF ENV-72-034031-A04)
(PB-281067/9; NSF/RA-770454) Avail: NTIS HC A07/MF A01 CSCL 13B

The generalized theory and models which were developed to establish an optimum meteorological and air pollution sampling network in urban areas are described. Three specific models are

required in order to determine the optimum network: a three-dimensional hydrodynamic model; a statistical model; and an objective variational analysis model. The basis of the network is the wind field in the urban area rather than the air pollution distribution. The primitive hydrodynamic model is used to simulate the wind field over a variety of cases in which the major factors influencing the flow (urban heat island, surface roughness variability, topography, etc.) are included. Simulation data were then used to develop the form of a statistical model which could be used to describe the wind distribution over the domain of the network. The air pollution distribution is obtained through an objective variational analysis model. The models were applied to develop an optimum network for St. Louis, Missouri. In the summer of 1975 and winter of 1976, field programs were conducted to test and evaluate the optimum network.GRA

N78-32619# GCA Corp., Bedford, Mass. Technology Div.
REGULATORY GUIDANCE FOR CONTROL OF VOLATILE ORGANIC COMPOUND EMISSIONS FROM 15 CATEGORIES OF STATIONARY SOURCES Final Report
Stephen V. Capone, Mark I. Bornstein, Robert J. Brennan, and William H. Battye Apr. 1978 209 p refs
(Contract EPA-68-02-2887)
(PB-281138/8; GCA-TR-78-15-G; EPA-905/2-78-001) Avail: NTIS HC A10/MF A01 CSCL 13B

Office of Air Quality Planning and Standards (OAQPS) Guidance is provided for regulation development in the form of sample regulations based heavily on the guidelines prepared by EPA for 15 categories of stationary sources as well as existing Federal and State laws. In addition a compendium of existing regulations and test procedures is given. The sample regulation are set forth in regulatory format definitions, emission limitations, equipment standards, exemptions, compliance schedules and testing methods and procedures. GRA

N78-32620# Illinois Univ. at Urbana-Champaign, Urbana. Inst. for Environmental Studies.
BASELINE DATA REQUIREMENTS FOR ASSESSING ENVIRONMENTAL IMPACT Final Report
Glenn E. Stout, Kent McGregor, Joe L. Spaeth, Keturah A. Reinbold, and G. Laurin Wheeler May 1978 141 p refs
(PB-281148/7; IIEQ-78/05) Avail: NTIS HC A07/MF A01 CSCL 13B

A guide used by technical personnel to perform an integrated baseline evaluation of changes in the total environment--in plants, soils, and animals (including man)--that is needed for a factual pinpoint assessment was developed. The methodology outlined requires substantial resources both in manpower and funds.GRA

N78-32621# Washington Univ., Seattle. Dept. of Civil Engineering.
REGIONAL ENVIRONMENTAL SYSTEMS: ASSESSMENT OF RANN PROJECTS
1978 413 p refs Proc. of workshop held at Seattle, 20-24 Jun. 1977
(Grant NSF EVA-76-04273)
(PB-282154/4; NSF/RA-780076) Avail: NTIS HC A18/MF A01 CSCL 13B

Representatives of eighteen Regional Environmental Systems (RES) projects funded by RANN met for a workshop to review their results. This report is presented in three volumes. Volume 1, 'Workshop Report,' includes goals of the workshop and reports from the following research groups: (1) information systems; (2) economic, population and land-use analysis; (3) resources and residual management; (4) ecosystem analysis; and (5) transfer and utilization. Volume 2, 'Assessments of Methodologies,' presents the following papers: (1) Information System Support of Regional Environmental Analysis; (2) Population, Economic, Employment, and Land Use Models; (3) Engineering, Planning and Resource Utilization Models; (4) Ecosystem and Resource Capability Models; (5) Thoughts on Model Evaluation (Software); (6) Thoughts on Model Evaluation (Software); (6) Assessment of RES Experiences; (7) Analytical Methods for Environmental Assessment and Decision Making; and (8) Citizen Participation. Volume 3, 'Project Summaries,' presents overviews of the 18 projects funded. GRA

N78-32622# California State Dept. of Transportation, Sacramento.
DESIGN OF AN AIR QUALITY MONITORING TRAILER FOR REGIONAL AIR QUALITY ASSESSMENT Interim Report, 1975 - 1976
K. O. Pinkerman, C. R. Sundquist, and E. C. Shirley Dec. 1977 28 p
(Contract DOT-FH-19-603116)
(PB-281532/2; FHWA-CA-TL-7169-77-28) Avail: NTIS HC A03/MF A01 CSCL 13B

Field data on ambient air pollution levels are required to assess transportation systems impact on the region air quality. A description of the design and development of an air monitoring trailer for measuring ambient levels of air pollution is presented. The analyzers used, their operation, and calibration procedures are equipped with carbon monoxide, oxides of nitrogen, ozone, and hydrocarbon analyzers. Data loggers are used to facilitate reduction of air pollution data. Calibration equipment and gases for the analyzers were incorporated in the trailer design and installation. GRA

N78-32623# Bureau of Mines, Pittsburgh, Pa.
GAS SAMPLING CAPABILITY OF VACUTAINERS Report of Investigations, 1978
Robert W. Freedman, Benjamin I. Ferber, and Wayne H. Duerr 1978 12 p refs
(PB-281082/8; BM-RI-8281) Avail: NTIS HC A02/MF A01 CSCL 14B

Vacutainers are used for sampling mine air and other atmospheres containing fixed gases, low-molecular-weight hydrocarbons, and products of combustion. Tests were conducted to study shelf life of evacuated samplers prior to sampling and also to check the stability of sampled gases prior to analysis. An unexplained phenomenon, slow accumulation of carbon monoxide in evacuated samplers, occurred after a few weeks' storage. Levels were low but increased with time and could pose a problem for critical applications. Accordingly, attempts to halt CO release by additional means of treatment were tried. Storage at low temperature was found to be effective. GRA

N78-32624# Battelle Columbus Labs., Ohio.
DEVELOPMENT OF A LARGE SAMPLE COLLECTOR OF RESPIRABLE PARTICULATE MATTER Research Report, 14 Jun. 1973 - 13 Apr. 1976
W. M. Henry, R. I. Mitchell, and Richard J. Thompson Jan. 1978 54 p refs
(Contract EPA-68-02-0752)
(PB-281528/0; EPA-600/4-78-009) Avail: NTIS HC A04/MF A01 CSCL 14B

A prototype sampler designed to collect particulate matter from air in sized fractions was designed and tested. The sampler excludes particles above 20 micrometers in diameter and collects fractions centered at 3.5 micrometers and 1.7 micrometers on impaction plates and smaller particles by electrostatic precipitation. The report includes test data, engineering drawings and materials list. GRA

N78-32625# Joint Publications Research Service, Arlington, Va
TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY: BIOMEDICAL AND BEHAVIORAL SCIENCES
8 Aug. 1978 42 p Transl. into ENGLISH from Russian journals
(JPRS-71641) Copyright. Avail: NTIS HC A03/MF A01

Public health aspects of air pollution monitoring and control methods are reported. For individual titles, see N78-32626 through N78-32628.

N78-32626# Joint Publications Research Service, Arlington, Va.
A METHOD OF ANALYSIS OF ECONOMIC LOSSES DUE TO ATMOSPHERIC POLLUTION OF POPULATED AREAS
K. P. Selyankina *In its* Transl. on USSR Sci. and Technol.: Biomedical and Behavioral Sci. 8 Aug. 1978 p 105-108 refs Transl. into ENGLISH from Gigiyena i Sanitariya (USSR), no. 5, 1978 p 46-49 (For primary document see N78-32625 23-45) Copyright. Avail: NTIS HC A03/MF A01

The morbidity rate was compared for groups of workers

working under the same conditions at the same enterprise and living in the same populated area, which is subject to the significant influence of industrial atmospheric pollution. One of the groups consisted of individuals who were born there and spent their childhood and youth there and the second consisted of individuals who arrived there only at the age of 18 years. The atmospheric waste from a nonferrous metallurgical enterprise polluted the air with sulfur dioxide, certain other gaseous compounds of sulfur and dust of a complex chemical composition. Results show that standardized morbidity indices were higher for both males and females in the local groups than the corresponding newcomer indices. Economic losses due to increased morbidity with temporary disability are projected for future employment periods of children currently living in this region. G.G.

N78-32627# Joint Publications Research Service, Arlington, Va.
GAS CHROMATOGRAPHY USED TO MEASURE PHTHALATE PLATICIZERS IN AIR WITH AN ELECTRON CAPTURE DETECTOR
M. T. Dmitriyen and V. A. Mishchikhin *In its* Transl. on USSR Sci. and Technol.: Biomedical and Behavioral Sci. 8 Aug. 1978 p. 109-113 refs Transl. into ENGLISH from Gigiyena Sanitariya (USSR), no. 5, 1978 p 59-62 (For primary document see N78-32625 23-45)
Copyright. Avail: NTIS HC A03/MF A01

An electron capture detector was used for gas chromatography of dibutyl phthalate (DBP) and dioctyl phthalate (DOP) in air. To assay phthalate plasticisers, air samples were collected in instruments filled with heptane or ethyl alcohol. G.G.

N78-32628# Joint Publications Research Service, Arlington, Va.
A METHOD OF LOWERING TOXICITY OF EXHAUST FROM INTERNAL COMBUSTION ENGINES
Endre Pattantyush-kh *In its* Transl. on USSR Sci. and Technol.: Biomedical and Behavioral Sci. 8 Aug. 1978 p 116-117 refs Transl. into ENGLISH from Gigiyena Sanitariya (USSR), no. 5, 1978 p 86-87 (For primary document see N78-32625 23-45)
Copyright. Avail: NTIS HC A03/MF A01

The use of ionizing readiation is proposed to lower exhaust toxicity of internal combustion engines that depend on hydrocarbon fuels. Radiochemical reactions break fuel particles down into smaller drops and thus provide for enhanced combustion and lower exhaust gas toxicity. G.G.

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N78-32629 California Univ., Berkeley.
LARGE SCALE D.C. ELECTRIC FIELDS IN THE EARTH'S ENVIRONMENT Ph.D. Thesis
Robert Haviland Holzworth, II 1977 150 p
Avail: Univ. Microfilms Order No. 7812607

Balloon campaigns to measure the stratospheric vector electric field simultaneously from several sites are described. Design and calibration procedures for the balloon-borne electric field detector are explained. Applicability of the measurements at balloon altitudes to the electric fields in the atmosphere, ionosphere and magnetosphere are demonstrated. A model in which atmospheric electrical conductivity enhancements result in the electric field changes is used to interpret observations. Simultaneous electric field measurements in the auroral zone were used to calculate the radial diffusion coefficient of energetic particles trapped in the earth's magnetic field. This calculation shows that the power in magnetospheric electric field fluctuations is primarily responsible for the energization and redistribution of the radiation belt particles. Dissert. Abstr.

N78-32630 Johns Hopkins Univ., Baltimore, Md.
A ROCKET STUDY OF VACUUM ULTRAVIOLET AURORAL EMISSIONS Ph.D. Thesis
Hongwoo Park 1978 148 p
Avail: Univ. Microfilms Order No. 7811789

Vacuum ultraviolet spectra of auroras were obtained from Aerobee sounding rockets launched at Fort Churchill, Manitoba, Canada. The wavelength ranges covered were from 750 to 1230 A and from 1190 to 1700 A at a spectra resolution of 13 A and 5.6 A, respectively. The observation and analysis of the extreme ultraviolet (EUV) spectrum is described. NA emission bands, which appear strongly in laboratory electron impact spectra, appear only as a modest background continuum between 900 and 1100 A. The total EUV flux is not as strong as theoretical predictions. The observed far ultraviolet spectrum is also analyzed. Results show a lower O density in the polar ionosphere compared to that at mid-latitude. Dissert. Abstr.

N78-32631 Rhode Island Univ., Kingston.
GROUPING OF MARINE SEDIMENTS USING A MULTIVARIATE ANALYSIS OF SEISMIC PROFILES Ph.D. Thesis
Stephan Douglas Milligan 1977 71 p
Avail: Univ. Microfilms Order No. 78-11469

A technique is presented for the study of seismic reflection profiles. The entire reflected waveform contains valuable information on the classification and characteristics of marine sediments. The multivariate statistics technique of principal component analysis is proposed for analyzing the variability in the shape and amplitude of the reflected waveform. The results of this analysis are used in conjunction with an improved cluster analysis program to produce maps of sediment distributions for a section of Narragansett Bay, Rhode Island. The groupings produced are in basic agreement with previous studies of the area. Preliminary regression equations are presented for converting the principal components to percentages of sand, silt, and clay. Dissert. Abstr.

N78-32632*# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.
STUDY OF DYNAMICS OF MINOR CONSTITUENTS IN THE THERMOSPHERE, ADDENDUM Final Report
Joe M. Straus and Lee A. Christopher Oct. 1978 131 p refs (Contract NAS1-14102)
(NASA-CR-145193) Avail: NTIS HC A07/MF A01 CSCL 04A

Numerical studies of a model of the earth's thermosphere are presented. The distribution of thermospheric helium was investigated. Changes in the global transport of helium under solstice conditions caused by a small increase in the latitudes at which the background gas pressure extremes occur lead to much better agreement of the model predictions with data taken by the mass spectrometers on board the ESRO-4 and OGO-6 satellites. The model was applied to a study of the global distributions of atmospheric gases (N2, O2, and O) at both equinox and solstice with emphasis on the winter enhancement of atomic oxygen in the lower thermosphere. Comparison of the results with measurements taken by the ESRO-4 mass spectrometer indicates that the distribution of atomic oxygen is generally a result of global transport by winds. S.B.S.

N78-32633*# National Aeronautics and Space Administration, Washington, D. C.
DIRECT METHOD FOR SOLVING TRANSFER EQUATION BY EXPANSION IN SPHERICAL HARMONICS: SCATTERING IN ATMOSPHERE WITH LAMBERTIAN LOWER BOUNDARY AND THERMAL RADIATION TRANSFER
Ye. A. Ustinov Sep. 1978 18 p refs Transl. into ENGLISH of "Pryamoy Metod Resheniya Uravneniya Perenosa Razlozheniyem po Sfericheskin Garmonikam: Rasseyaniye v Atmosphere S Lambertovskoy Podstilayushchey Poverkhnostyu i Perenos Teplovogo izhuncheniya", Rept. PR-307 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1978 p 1-16 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75549; PR-307) Avail: NTIS HC A02/MF A01 CSCL 04A

The direct method for the solution of the spherical harmonics approximation to the equation of transfer of radiation is applied to the cases of (1) scattering of the solar radiation in the atmosphere with the Lambertian boundary and (2) thermal radiation transfer. Author

N78-32634*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPARATIVE PLANETOLOGY: SIGNIFICANCE FOR TERRESTRIAL GEOLOGY
Herbert Frey and Paul D. Lowman Jan. 1978 18 p refs Submitted for publication
(NASA-TM-78051) Avail: NTIS HC A02/MF A01 CSCL 08G

The crustal evolution of the terrestrial planets increase in complexity and duration with increasing size and mass of the planet. The lunar and mercurian surfaces are largely the result of intense, post-differentiation impact bombardment and subsequent volcanic filling of major impact basins. Mars, being larger, has evolved further: crustal uplifts, rifting, and shield volcanoes have begun to modify its largely Moon-like surface. The Earth is the large end-number of this sequence, where modern plate tectonic processes have erased the earlier lunar and martian type of surfaces. Fundamental problems of the origin of terrestrial continents, ocean basins, and plate tectonics are now addressed within the context of the evolutionary pattern of the terrestrial planets. L.S.

N78-32635*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FIRST RESULTS FROM THE SIX-AXIS ELECTRON SPECTROMETER ON ISEE-1
Keith W. Ogilvie and Jack D. Scudder Sep. 1978 27 p refs Submitted for publication
(NASA-TM-79637) Avail: NTIS HC A03/MF A01 CSCL 04A

A survey, using results from the first 25 orbits of ISEE-1, was made of some aspects of electrons in the dawn magnetosheath. There are indications that the flow of plasma is not uniformly turbulent over this region. The electron heat flux is observed to be directed away from the shock and to have an average value of about twice the interplanetary heat flux. Many magnetopause crossings were observed and usually resemble abrupt transitions from one well-defined plasma state to another. The ejection of plasma from flux tubes convected up against the magnetopause is observed for about half the time, and its thickness and dependance on the solar wind Mach number agrees with theoretical predictions. A full traversal of the whole forward hemisphere of the magnetosheath is required to fully confirm these deductions. Author

N78-32636# Photometrics, Inc., Lexington, Mass.
ASSESSMENT AND EVALUATION OF SIMULATION DATA Final Report, 1 Mar. - 15 Oct. 1977
I. L. Kofsky, D. P. Villanucci, and G. Davidson 15 Nov. 1977 139 p refs
(Contract DNA001-77-C-0208)
(AD-A055884; AD-E300220; PHM-01-78; DNA-LTAES-69; DNA-4303F) Avail: NTIS HC A07/MF A01 CSCL 04/1

Radiance data from the charged particle-stimulated ionosphere in the wave-length band 4.2-4.3 micrometers (from ICECAP/HAES multi-instrumented rocket A18.219-1, 1974) are evaluated; the performance of two diagnostic photometer systems flown on sounding rockets is assessed; a procedure for determining pointing relative to prompt and past air excitation of a rocket-borne interferometric spectrometer (on IC630.02-1A (HIRIS II), 1976) is developed; and photometry and positioning data for 1976 aircraft flights at auroral latitudes to measure spatial structure in infrared radiance are presented. The radiation flux near 4.3 micrometers at low elevation angles (approximately 5-15 deg) has both layering irregularities and a component associated with prompt energy deposition in the atmosphere. The altitude structure is interpreted as an effect of adding collisional transfer of N2 vibrational energy excited by aurora-producing particles to the population of CO2(++) by transport of thermal radiation. Aeronomic mechanisms that could be responsible for the near-prompt infrared mechanism are reviewed critically. GRA

N78-32637# Denver Univ., Colo. Dept. of Physics.
INFRARED BACKGROUND MEASUREMENTS
David G. Murcray, Frank H. Murcray, and Walter J. Williams Apr. 1978 19 p ref
(Contract DAAD05-76-C-0740)
(AD-A055709; AD-E430039; ARBRL-CR-00370) Avail: NTIS HC A02/MF A01 CSCL 04/1

This report contains the findings of balloon flights in 1977 which studied enhanced infrared emissions which have been observed at high altitudes (above 40 km) in the Fairbanks, Alaska area. Very weak fluctuations were observed for very short periods of time. GRA

N78-32638# Naval Research Lab., Washington, D. C. Plasma Physics Div.
THE RESPONSE OF THE ZONALLY AVERAGED CIRCULATION TO STRATOSPHERIC OZONE REDUCTIONS Interim Report
M. R. Schoeberl and Darrell F. Strobel Apr. 1978 20 p refs (RR0330341)
(AD-A056357; AD-E000173; NRL-MR-3631) Avail: NTIS HC A02/MF A01 CSCL 04/1

The effects of various ozone density reductions on the zonally averaged circulation are evaluated with a numerical quasigeostrophic model. If the ozone perturbations are confined to the polar regions and are miniscule on a global basis as was characteristic of the August 1972 solar proton event, then the calculations indicate a negligible effect on the mean circulation. For global ozone perturbations by predicted halocarbon pollution, the difference between a 10% reduction in the zonal jet strength and less than a 5% change in global mean stratospheric temperature was calculated. Large, uniform ozone reductions (= 50%) produce significant effects on the mean circulation: a substantial collapse of the stratosphere due to cooler temperature and a weak polar night jet. The reflection and transmission of quasi-stationary planetary waves in the middle atmosphere are computed to be insensitive to solar activity as extreme as the August 1972 solar proton event. It thus seems improbable that planetary waves are a viable mechanism for solar-weather interactions that involve perturbations of the zonally averaged circulation by ozone density reductions. Author (GRA)

N78-32639# Saint Louis Univ., Mo. Dept. of Earth and Atmospheric Science.
ANALYSIS OF STRONG MOTION DATA FROM THE NEW MADRID SEISMIC ZONE 1975 - 1976
Robert B. Herrmann Aug. 1977 151 p refs
(Contract NSF ENV-76-20875)
(PB-280148/8; NSF/RA-770309) Avail: NTIS HC A08/MF A01 CSCL 08K

Strong motion data from three earthquakes is presented. One accelerograph was triggered by the mb = 4.2 June 13, 1975 event, seven were triggered by an mb = 5.0 event on March 25, 1976, and one was triggered by an mb = 4.5 aftershock on March 25, 1976. The strong motion data were processed using the computer programs developed at CALTECH. The raw digitized accelerograms, as well as the calculated ground acceleration, velocity and displacements are presented in tabular and graphic form. GRA

N78-32117# Indian Space Research Organization, Ahmedabad. Space Application Center.
THE EARTH'S ENVIRONMENT
P. N. Pathak *In* Indian Inst. of Sci. Space Sci., Technol. and Appl.: An Overview Apr. 1978 8 p refs (For primary document see N78-32114 23-12)
Avail: NTIS HC A10/MF A01

N78-32154*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE GRAVITATIONAL WAVE DETECTION EXPERIMENT: DESCRIPTION AND ANTICIPATED REQUIREMENTS
A. L. Berman *In its* The Deep Space Network 15 Aug. 1978 p 100-108 (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 08N

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N78-32640 Drexel Univ., Philadelphia, Pa.
NUMERICAL EXPERIMENTS ON BOUNDARY LAYER

EFFECTS ON FRONTAL STRUCTURE Ph.D. Thesis
John Edward Pinkerton 1978 226 p
Avail: Univ. Microfilms Order No. 7814398

A two-dimensional numerical model was developed to study the effects of surface friction and daytime surface heating on a developing cold frontal zone. Horizontal wind and temperature were predicted with a hydrostatic primitive equation set in a plane normal to the frontal zone. Initial conditions were specified analytically to simulate a realistic cold frontal zone at a time shortly after sunrise. The development of the frontal zone structure and the transverse circulation in the plane normal to the frontal zone were studied in a series of numerical experiments performed with the model. Results demonstrate the complexity of frontal zone development in the planetary boundary layer and the substantial interplay of various physical mechanisms.
Dissert. Abstr.

N78-32641*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE EFFECTS OF CURVATURE AND VISCOSITY ON BAROCLINIC INSTABILITY: A TWO-LAYER MODEL
William W. Fowlis and Salvador Arias Sep. 1978 31 p refs
(NASA-TP-1328; M-264) Avail: NTIS HC A03/MF A01 CSCL 04B

A linear stability analysis of a baroclinic zonal current contained between two parallel rigid boundaries is presented. Curvature is included by performing the analysis on a beta b-plane and viscosity by allowing for the effects of Ekman layers on the rigid boundaries. A two-layer model is used. This calculation was carried out to assist in the design of a spherical model of the general circulation of the earth's atmosphere for Spacelab. In the low-gravity environment on an orbiting vehicle, a dominant radial dielectric body force, analogous to planetary gravity, can be achieved over a volume of liquid held between two concentric spheres. The results show the Eady short wavelength cutoff, and long wavelength cutoffs due to Ekman damping and curvature.
Author

N78-32642*# National Aeronautics and Space Administration, Washington, D. C.
SOME PRINCIPLES FOR STUDYING REDUCED VISIBILITY CONDITIONS IN REGIONS AROUND AIRPORTS
N. N. Romanov, Z. Ye. Babenko, and M. N. Yaroslavtseva Aug. 1977 9 p Transl. into ENGLISH from Vopr. Sinopticheskoy i Aviats. Meteorologii, Tr., Sredneaziatskiy Regionalnyy Nauchno-Issled. Gidrometeorol. Inst. (Leningrad), no. 5, 1973 p 117-121 Original language document was announced as A74-37224 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-2790)
(NASA-TM-75152) Avail: NTIS HC A02/MF A01 CSCL 04B

A set of guidelines based on the experiences of the meteorological team at Tashkent airport is presented. These guidelines pertain to all the possible immediate and specific sources of relevant information in the vicinity of a given airport and to the combination of theoretical and experimental information which should be used in evaluating the data.
B.B.

N78-32643# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
ANALYSIS OF ENERGY-CONSISTENCY OF SIMPLE WEATHER PREDICTION MODELS
Alewyn P. Burger (Office of the Sci. Advisor to the Prime Minister, Pretoria) and Hilarie A. Riphagen Jan. 1978 58 p refs
(CSIR-SR-SWISK-1; ISBN-0-7988-1286-4) Avail: NTIS HC A04/MF A01

Approximations to the equations governing atmospheric motion are assessed. Pressure is used as a vertical coordinate where the correct kinematic boundary condition applies at the surface of the earth. Characteristic values are assigned to the variables appearing in the equations. Scaled forms of the basic equations and associated energy equations, including that for available potential energy, are obtained as expansions in terms of the Rossby number as a small parameter. An atmosphere which is quasihydrostatic, adiabatic, frictionless, quasigeostrophic, stratified, of limited static stability, and of moderate horizontal scale is characterized. The requirement of conservation of total energy is presented as a criterion in finding consistent approximations to the basic equations. The unsuitability of using approximations of available potential energy to justify omissions from the basic equation is discussed.
S.B.S.

N78-32644# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
THE 14820A LANCE MISSILE NO. 3316, ROUND NO. 310 APT (25 JANUARY 1978) Meteorological Data Report
Jan. 1978 30 p
(DA Proj. 1T6-64702-D-127-02)
(AD-A054799; ECOM-DR-962) Avail: NTIS HC A03/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 14820A Lance, Missile Number 3316, Round Number 310 APT, are presented in tabular form.
Author (GRA)

N78-32645# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
THE 14819A LANCE MISSILE NO. 3315, ROUND NO. 309 APT (25 JANUARY 1978) Meteorological Data Report
Jan. 1978 46 p
(DA Proj. 1T6-65702-D-127-02)
(AD-A054798; ECOM-DR-961) Avail: NTIS HC A03/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 14819A Lance, Missile Number 3315, Round Number 309 APT, are presented in tabular form.
Author (GRA)

N78-32646# Air Force Geophysics Lab., Hanscom AFB, Mass.
THE DEVELOPMENT OF A FIXED BASE AUTOMATED WEATHER SENSING AND DISPLAY SYSTEM Scientific Interim Report
William R. Tahnk and Richard H. Lynch 6 Oct. 1978 23 p ref
(AF Proj. 6670)
(AD-A054805; AFGL-TR-78-0009; AFGL-IP-260) Avail: NTIS HC A02/MF A01 CSCL 04/2

The Meteorology Division of the Air Force Geophysics Laboratory developed a computer-based observing system called MAWS(Modular Automated Weather System) to demonstrate the feasibility of automated observing and forecasting techniques using low-cost microcomputers. Scott AFB, Illinois, was chosen as the demonstration site, and operation commenced in January 1977. Instrumentation at five observing sites is polled periodically each minute, and then the data are transmitted on command to the central site over voice grade telephone lines using microcomputers that were designed, built, and programmed by the authors. This use of on-site processing eliminated the need for expensive, high speed lines as well as centralized processing. Instead, a microcomputer in the base weather station acts as a supervisor to the four on-site microcomputers, directing the flow of information throughout the network. Parameters observed automatically include wind, temperature, visibility, pressure, and cloud base height. In addition, short range forecasts of visibility and cloud base height are generated. These data are then displayed on alphanumeric display devices located in operations centers around the base. MAWS data are also continually archived and the capability exists for hard copy printout when desired.
Author (GRA)

N78-32647# Weather Wing (1st), Hickam AFB, Hawaii.
OCCURRENCE OF TYPHOONS/TROPICAL STORMS (1949-1969) AT SELECTED LOCATIONS (UPDATED THROUGH 1977 FOR SIX PACIFIC BASES)
Jun. 1978 55 p
(AD-A055750; Rept-1WW-SS-105-55) Avail: NTIS HC A04/MF A01 CSCL 04/2

Both the occurrences of typhoons and the occurrences of typhoons and tropical storms within 60, 120, and 240 nautical miles are presented by month for 106 Western Pacific locations. The occurrences for Clark AB PI, Kadena AB JA, Yokota AB JA, Kunsan AB ROK, Osan AB ROK, and Andersen AFB GU, have been updated to include 1970-1977 data.
Author (GRA)

N78-32648# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
RELATION OF INFRARED DOPPLER LIDAR TO REMOTE WIND MEASUREMENTS IN THE TURBULENT ATMOSPHERE Final Report, 1 Feb. 1976 - 31 Jan. 1978

R. L. Schwieson and R. F. Calfee 31 Mar. 1978 12 p refs Sponsored by Army
(AD-A055682; ARO-13470.20-GSX) Avail: NTIS HC A02/MF A01 CSCL 20/5

The performance of a coherent Doppler lidar is affected by the atmosphere. Refractive index inhomogeneities limit the effective aperture of our system to 15.5 cm + or - 4% on the average for a 2.6 km horizontal path 2 m above the surface under daytime conditions. Effective aperture scales as range to the -3/5 power. A differential Doppler technique can measure the wind vector in a single atmospheric volume with three (or more) closely-spaced beams. This method works even when the distribution of velocities in the volume is wider than the velocity separation from beam angle differences. The structure function for backscatter and wind inhomogeneities scales approximately as r to the 2/3 power between the minimum detectable scale in our experiment and an outer scale of 100 to 500 m, depending on atmospheric condition. Author (GRA)

N78-32649# Battelle Pacific Northwest Labs., Richland, Wash.
ESTIMATES OF THE NUMBER OF LARGE AMPLITUDE GUSTS
J. V. Ramsdell Mar. 1978 55 p refs
(Contract EY-76-C-06-1830)
(PNL-2508) Avail: NTIS HC A04/MF A01

Preliminary estimates for use in the design of wind energy conversion systems are presented. Existing turbulence information was combined with an assumed wind speed distribution to arrive at the estimates. The number of large amplitude gusts per year was treated as a function of the annual mean wind speed and terrain roughness. This treatment is based upon the assumptions that the atmosphere has neutral stability during high winds and that the gustiness is induced by flow over surface roughness elements. Large gusts during thunderstorms and other severe weather phenomena are not treated. The results of the study are presented in tabular form as a function of gust amplitude and hourly average wind speed. ERA

N78-32650# National Technical Information Service, Springfield, Va.
CLOUD SEEDING, VOLUME 1. A BIBLIOGRAPHY WITH ABSTRACTS Final Report, 1964 - 1975
Robena J. Brown Jun. 1978 267 p
(NTIS/PS-78/0522/9) Avail: NTIS HC $28.00/MF $28.00 CSCL 04B

This updated bibliography contains 258 abstracts. Generalized studies on cloud seeding techniques and theory, including environmental and water resources planning studies are covered. The results of specific cloud seeding experiments are given.GRA

N78-32651# National Technical Information Service, Springfield, Va.
CLOUD SEEDING, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Final Report, 1964 - May 1978
Robena J. Brown Jun. 1978 98 p Supersedes NTIS/PS-77/0474; NTIS/PS-76/0386; NTIS/PB-75/395 and COM-73-11727
(NTIS/PS-78/0523/7; NTIS/PS-77/0474; NTIS/PS-76/0386; NTIS/PS-75/395; COM-73-11727) Avail: NTIS HC $28.00/MF $28.00 CSCL 04B

This updated bibliography contains 89 abstracts on cloud seeding techniques and theory. Environmental and water resources planning is included along with results of specific cloud seeding experiments. GRA

N78-32652# Illinois State Water Survey, Urbana.
SUMMARY OF METROMEX, VOLUME 1: WEATHER ANOMALIES AND IMPACTS
Stanley A. Changnon, Floyd A. Huff, Paul T. Schickedanz, and John L. Vogel 1977 267 p refs
(Grants NSF ENV-73-07706; NSF GA-28189)
(PB-281168/5; ISWS/BUL-62/77-Vol-1; W78-06738) Avail: NTIS HC A12/MF A01 CSCL 04B

The major findings from the 1971-1975 METROMEX field operations at St. Louis are presented. The final interpretations and conclusions obtained primarily through climatological-statistical analyses of spatial and temporal distributions of surface precipitation and severe storms are focused. The impacts related to the urban-produced precipitation anomalies are addressed. The urban-induced anomalies occur most often with squall lines and cold fronts; they maximize in the afternoon and again at night (2100-2400); they appear to be as active in dry periods as in wet periods. Impacts include more runoff, but also more local flooding, soil erosion, silting, and water pollution. GRA

N78-32653# Oklahoma Univ., Norman. Dept. of Meteorology.
A CONTRIBUTION TO THE TORNADO INTERCEPT PROJECT 1977
J. Kimpel, H. Bluestein, J. McGinley, L. Ruthi, and D. Engles Dec. 1977 58 p
(Contract NOAA-04-7-022-44018)
(PB-281818/5; NOAA-78042005) Avail: NTIS HC A04/MF A01 CSCL 04B

Areas directly related to improving the issuance of severe thunderstorms/tornado watches and warnings to the general public are described. An objective forecast technique was developed and employed as part of an attempt to intercept severe weather events through the use of mobile intercept teams. The surface-based objective forecast technique was improved by changing the radius of influence and the filter parameter in the objective analysis scheme. A time-averaging technique was also employed in wind-field analyses. These changes improved the representation and continuity of movement of the output fields. Quantities calculated included surface-equivalent potential temperature, convergence of surface-equivalent potential temperature flux, convergence of dew-point temperature flux, and relative vorticity. The success of the forecast and intercept program is evident in the large number of severe storms intercepted. In all, twenty-two tornadic storms were photographed and documented by mobile teams. GRA

N78-32654# National Weather Service, Fort Worth, Tex. South Region.
A FLASH FLOOD AID: THE LIMITED AREA QPF (QUANTITATIVE PRECIPITATION FORECAST)
James Belville, G. Alan Johnson, and Jimmy Don Ward Mar. 1978 14 p refs
(PB-281886/2; NOAA-TM-NWS-SR-97) Avail: NTIS HC A02/MF A01 CSCL 04B

The Quantitative Precipitation Forecast (QPF) shows the areal distribution and the amount of rainfall expected to occur over a given period of time. The most important facet of the QPF is that it alerts the forecasters to the potential for excessive rains. The Lubbock QPF procedures were developed primarily to indicate the maximum amount of precipitation expected within an area. Parameters investigated were climatology, certain 500 mb flow patterns, and five atmospheric variables which were found to correlate well with episodes of heavy rain. These variables were lifted index, K-index, mean relative humidity (surface to 500 mb), tropopause temperatures, and precipitable water. GRA

N78-32655# National Center for Atmospheric Research, Boulder, Colo.
DESCRIPTION AND OPERATIONAL ASPECTS OF THE NCAR SEGMENTED LIMITED AREA MODEL (LAMSEG)
Richard A. Valent, Patrick H. Downey, and John L. Donnelly Oct. 1977 116 p refs
(Grant NSF ATM-77-23757)
(PB-280664/4; NCAR-0501-77/08) Avail: NTIS HC A06/MF A01 CSCL 04B

An overview of the NCAR Segmented Limited Area Model (LAMSEG) is given with emphasis on data structures and transfers. Most of LAMSEG's basic equations, physical processes, and finite-difference equations are those of the NCAR second-generation general circulation model (GCM). Furthermore, forecasting with LAMSEG is a two-step procedure involving the GCM: first, a slightly modified GCM is run to produce a boundary data tape (BDT), and then LAMSEG is run with the boundary data. GRA

N78-32656# National Oceanic and Atmospheric Administration, Washington, D. C. Center for Experiment Design and Data Analysis.
GATE CONVECTION SUBPROGRAM DATA CENTER: RAWINSONDE DATA VALIDATION

Robert W. Reeves Mar. 1978 34 p refs
(PB-281861/5; NOAA-TR-EDS-29; NOAA-78042504) Avail: NTIS HC A03/MF A01 CSCL 04B

Processing and editing techniques used by the Convection Subprogram Data Center are described. These techniques were used in validating the rawinsonde data collected during the three observation Phases of the 1974 GARP Atlantic Tropical Experiment. Intercomparison analyses of the various rawinsonde systems are presented, and data problems are identified. GRA

N78-32657# National Oceanic and Atmospheric Administration, Washington, D. C.
COMPARISON OF MAST AND BOOM WIND SPEED AND DIRECTION MEASUREMENTS ON US GATE B-SCALE SHIPS
Katherine B. Kidwell and Ward R. Seguin Mar. 1978 44 p refs
(PB-281887/0; NOAA-TR-EDS-28; NOAA-7842503) Avail: NTIS HC A03/MF A01 CSCL 04B

Wind measurements were made aboard four U.S. ships with identical microvane and cup anemometers mounted on the forward masts and on booms extending from the ships' bows. Study of the simultaneous wind observations by the mast and boom sensors shows wind speed differences varying from 0 to 1.0 m/s and wind directions varying between + or - 15 degrees for relative wind directions from 270 through 0 to 90 degrees. These differences are dependent upon the relative wind direction, the wind speed, the heights of the sensors above sea level, the exposure of the sensor, and atmospheric stability. Wind speed differences are found to increase linearly when the wind direction is on the bow and in some case non-linearly when the ship lies normal to the wind. Specific biases in the wind measurements for each of the four ships are tabulated for the benefit of users of the archived GATE surface data. ERA

N78-32658# National Oceanic and Atmospheric Administration, Washington, D. C.
PROCEEDINGS OF THE SECOND ANNUAL NOAA CLIMATE DIAGNOSTICS WORKSHOP
W. A. Sprigg, ed. Oct. 1977 372 p refs Workshop held at La Jolla, Calif., 18-20 Oct. 1977
(PB-282151/0; NOAA-78042603) Avail: NTIS HC A16/MF A01 CSCL 04B

Several views of the previous year's climate--many of which are centered on the unusual characteristics of the Northern Hemisphere winter of 1976-77 are offered. Some of the subject areas discussed were: long-term records derived from tree-ring analyses; specific factors (deserts, clouds and ozone)that may influence or become components of climate variation; and the ocean as an element of climate. The workshop also afforded an opportunity to examine the use of the empirical orthogonal function in diagnostic studies of climate. GRA

N78-32659# National Oceanic and Atmospheric Administration, Washington, D. C. Environmental Data Service.
STANDARD DEVIATION OF MONTHLY AVERAGE TEMPERATURE IN THE UNITED STATES
Richard M. Whiting (Natl. Climatic Center) Apr. 1978 34 p refs Supersedes report dated 1968
(PB-282152/8; NOAA-TR-EDS-3; NOAA-78041807) Avail: NTIS HC A03/MF A01 CSCL 04B

Maps of the distribution of standard deviation of monthly average temperature over the United States are given. These are based on the 1941-1970 period. A brief history of the derivation of United States normal temperatures and of past work on standard deviation distribution is presented. As an example, changes during this century in the standard deviation of January temperature at Lincoln, Neb., are discussed. A 1968 report by H.C.S. Thom is reprinted as an Appendix discussing confidence intervals, probabilities, quantities of temperature functions, and approximation of normal monthly degree days as applications of standard deviation of temperature data. GRA

N78-32660# Wisconsin Univ., Madison. Inst. for Environmental Studies.
ESTIMATING PROBABLE AGRICULTURAL CLIMATES OF THE NORTHERN HEMISPHERE FOR THE COMING DECADE Final Report
Reid A. Bryson Dec. 1977 268 p refs
(Grant NOAA-04-6-158-44071)
(PB-282453/0; NOAA-78041401) Avail: NTIS HC A12/MF A01 CSCL 04B

An attempt to assess the most probable agricultural climates of the coming decade, presented as maps of mean temperature and precipitation for the major agricultural regions is made. The methods used, an estimate of the skill attained on independent data, and preliminary climatic forecasts for North America and India for the 1976-1980 period are presented. GRA

N78-32661# National Technical Information Service, Springfield, Va.
PRECIPITATION WASHOUT. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Jul. 1978
Robena J. Brown Jul. 1978 131 p Supersedes NTIS/PS-77/0658; NTIS/PS-76/0572; NTIS/PS-75/517
(NTIS/PS-78/0657/3; NTIS/PS-77/0658; NTIS/PS-76/0572; NTIS/PS-75/517) Avail: NTIS HC $28.00/MF $28.00 CSCL 04B

The reports cited cover the removal of pollutants, radioactive isotopes, and dust by rain and snow. The theory, modelling, sampling and effects of precipitation washout are presented. (This updated bibliography contains 126 abstracts, 14 of which are new entries to the previous edition.) GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N78-32662# Washington Univ., Seattle. Div. of Marine Resources.
SHORELINES MANAGEMENT 1977: PERFORMANCE AND PROSPECTS
Robert F. Goodwin Sep. 1977 169 p refs Proc. of a Conf. and Workshop for Practitioners and Users, Seattle, Wash., 22-23 Sep. 1977
(PB-281928/2; WSG-WO-77-3; NOAA-78041701) Avail: NTIS HC A08/MF A01 CSCL 13B

Shorelines management in Washington State is entering its seventh year. Virtually all local governments with marine or freshwater resources now have approved Master Programs guiding the conservation and development of their shorelines. The evaluations and recommendations for ongoing activities were presented in sessions on: shoreline environmental management and community development; management of aquatic areas are: policies and guidelines; legal and legislative issues; and shorelines management administration. GRA

N78-32663# National Technical Information Service, Springfield, Va.
REMOTE SENSING OF THE OCEAN. PART 1: PHYSICAL, CHEMICAL, AND GEOLOGICAL PROPERTIES, VOLUME 1. A BIBLIOGRAPHY WITH ABSTRACTS Final Report, 1970 - 1975
Robena J. Brown Jun. 1978 179 p
(NTIS/PS-78/0562/5) Avail: NTIS HC $28.00/MF $28.00 CSCL 08C

A description is given of remote sensing methods as they are applied to ocean temperature, sea ice, marine biology, marine geology, and sound and light transmission. Techniques of measurement using radiometry, microwave spectroscopy, radar systems, infrared spectroscopy, and photography are described. These measurements are made from both aircraft and satellites. GRA

N78-32664# National Technical Information Service, Springfield, Va.
REMOTE SENSING OF THE OCEAN. PART 1: PHYSICAL, CHEMICAL, AND GEOLOGICAL PROPERTIES, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Final Report, 1976 - May 1978
Robena J. Brown Jun. 1978 81 p Supersedes NTIS/PS-77/0532; NTIS/PS-76/0468; NTIS/PS-75/446
(NTIS/PS-78/0563/3; NTIS/PS-77/0532; NTIS/PS-76/0468;

NTIS/PS-75/446) Avail: NTIS HC $18.00/MF $28.00 CSCL 08J

This updated bibliography contains 75 abstracts. The studies describe remote sensing methods as they are applied to ocean temperatures, sea ice, marine biology, marine geology, and sound light transmission. Techniques of measurement using radiometry, microwave spectroscopy, rad systems, infrared spectroscopy, and photography are described. These measurements are made from both aircraft and satellites. GRA

N78-32665# National Technical Information Service, Springfield, Va.

REMOTE SENSING OF THE OCEAN. PART 2: DYNAMICS. A BIBLIOGRAPHY WITH ABSTRACTS Final Report, 1970 - May 1978

Robena J. Brown Jun. 1978 147 p Supersedes NTIS/PS-77/0533; NTIS/PS-76/0469; NTIS/PS-75/447

(NTIS/PS-78/0564/1; NTIS/PS-77/0533; NTIS/PS-76/0469; NTIS/PS-75/447) Avail: NTIS HC $28.00/MF $28.00 CSCL 08J

Remote sensing methods as they are applied to ocean currents, wind sediment transport, ocean waves, sea states, and air water interactions are described. The various techniques of measurement using radiometers, lasers, radar, and microwave and infrared equipment are described. GRA

N78-32666# National Center for Atmospheric Research, Boulder, Colo.

A NUMERICAL SIMULATION OF THE ANNUAL CYCLE OF SEA ICE IN ARCTIC AND ANTARCTIC Ph.D. Thesis - Ohio State Univ. Final Report

Claire Lucille Parkinson 1978 210 p refs

(Grant NSF ATM-77-23757)

(PB-279789/2; NCAR-CT-46) Avail: NTIS HC A10/MF A01 CSCL 08J

The model employs a rectangular grid with 200 km horizontal resolution, an 8 hr timestep, and four vertical layers-ice, snow, ocean, and atmosphere. Both thermodynamic and dynamic processes are incorporated, the thermodynamics being based on energy balances at the various interfaces and the dynamics being based on the following five stresses: wind stress, water stress, Coriolis force, internal ice resistance, and the stress from the tilt of the sea surface. Although the ice within a given grid square is of uniform thickness, each square also has a variable percentage of its area assumed ice-free. The model simulates a reasonable yearly cycle of sea ice thickness and extent in both the Arctic and Antarctic. The Antarctic ice grows from a minimum in March to a maximum in late August, while the Arctic ice expands from a September minimum to a March maximum. Overall, both thicknesses and concentrations are greater in the Arctic than in the Antarctic. GRA

N78-32667# Miami Univ., Coral Gables, Fla. Dept. of Physics.

SHEAR FLOW INSTABILITY AS A SOURCE OF INTERNAL WAVES ON THE CONTINENTAL SHELF

John Jengshyong Tsai Dec. 1977 187 p refs Sponsored in part by DARPA

(Grant NOAA-04-6-022-44005)

(PB-281864/9; NOAA-78042006) Avail: NTIS HC A09/MF A01 CSCL 08C

Internal wave packets on the continental shelf were studied. Temperature and acoustic echo-sounder measurements show that these are essentially undulatory internal bores perhaps having tidal origin. An instability calculation indicates the source of the undulations is local shear flow instability. The vertical velocity perturbation for waves of maximum amplication always has two peaks, located around the two interfaces and a subsidiary minimum at the critical layer. The form of this eigenfunction agrees qualitatively with the results derived from temperature profile made at the internal wave troughs and crests off Long Island. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N78-32668*# National Aeronautics and Space Administration, Washington, D. C.

ENDOGENOUS HISTAMINE AND PROMETHAZINE-INDUCED GASTRIC ULCERS IN THE GUINEA PIG

B. Djahanguiri and M. Hemmati Sep. 1978 7 p refs Transl. into ENGLISH from Therapie (France), v. 25, 1970 p 611-614 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Teheran Univ., Iran

(Contract NASw-3199)

(NASA-TM-75341) Avail: NTIS HC A02/MF A01 CSCL 06C

Experiments performed with an inhibitor of diaminoxydase, aminoguanidine and an inhibitor of histidine decarboxylase, NSD 1055, showed that the frequency of gastric ulcers induced by promethazine was increased with the first inhibitor and decreased with the second. It is suggested that ulcers induced by promethazine in guinea pigs might be due to histamino-liberator effect of the antihistaminio compound. Author

N78-32669*# National Aeronautics and Space Administration, Washington, D. C.

THE EFFECT OF SEAWATER ON THERMOREGULATOR CENTERS

Spyr. Dontas and Eug. Phocas Aug. 1978 10 p refs Transl. into ENGLISH from Prakt. Akad. Athenon (Greece), v. 14, 26 Jan. 1939 p 83-88 Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(Contract NASw-3199)

(NASA-TM-75443) Avail: NTIS HC A02/MF A01 CSCL 06C

Experiments were done on dogs to determine the mechanism of thermoregulation. Results show that natural seawater, injected intravenously (150, 200, and 300 cc), causes narcosis of the thermic centers and increases temperature. Diluted seawater injection causes an excitation of the thermic centers and an antipyretic effect. S.B.S.

N78-32670*# National Aeronautics and Space Administration, Washington, D. C.

THE EFFECT OF VARIOUS DRUGS ON EXPERIMENTALLY INDUCED ULCERS IN IMMOBILIZED RATS

H. Schramm Sep. 1978 16 p refs Transl. into ENGLISH from Deut. Z. Verdau.-Stoffwechselkrankh (East Germany), v. 28, no. 5/6, 1968 p 305-312 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Friedrich-Schiller Univ., Jena

(Contract NASw-3199)

(NASA-TM-75340) Avail: NTIS HC A02/MF A01 CSCL 06C

Experiments related to the importance of functional disorders in the central nervous system in connection with stomach diseases were performed on Wistar rats. Assuming that severe mental strains may be triggering factors for such disorders, testing of the effects of different drugs on experimentally induced ulcers in these rats was done. The immobilization method described by Bonfils was used. Particular importance was placed on the sex related difference which appeared. B.B.

N78-32671*# Boeing Co., Houston, Tex.

RESEARCH AND DEVELOPMENT OF A LUMINOL-CARBON MONOXIDE FLOW SYSTEM Monthly Report, Apr. - Jun. 1977

Richard R. Thomas Jun. 1977 39 p refs

(Contract NAS5-22545)

(NASA-CR-156832; MR-7) Avail: NTIS HC A03/MF A01 CSCL 06M

Adaption of the luminol-carbon monoxide injection system to a flowing type system is reported. Analysis of actual wastewater samples was carried out and revealed that bacteria can be associated with particles greater than 10 microns in size in samples such as mixed liquor. Research into the luminol reactive oxidation state indicates that oxidized iron porphyrins, cytochrome-c in particular, produce more luminol chemiluminescence than the reduced form. Correlation exists between the extent of porphyrin oxidation and relative chemiluminescence. In addition, the porphyrin nucleus is apparently destroyed under the current chemiluminescent reaction conditions. G.G.

N78-32672# Joint Publications Research Service, Arlington, Va.

SPACE BIOLOGY AND AEROSPACE MEDICINE, NO. 4

O. G. Gazenko, ed. 7 Sep. 1978 138 p refs Transl. into ENGLISH of Kosmich. Biol. Aviakosmich. Med. (Moscow), no. 4, Jul./Aug. 1978 89 p
(JPRS-71830) Copyright. Avail: NTIS HC A07/MF A01

Physiological responses to space flight stress are presented along with selection criteria of cosmonauts. For individual titles, see N78-32673 through N78-32696.

N78-32673# Joint Publications Research Service, Arlington, Va.
SOME PRESSING PROBLEMS OF SETTING PHYSIOLOGICAL-HYGIENIC STANDARDS FOR NOISE IN AEROSPACE MEDICINE **c71**
Yu. V. Krylov *In its* Space Biol. and Aerospace Med., No. 4 (JPRS-71830) 7 Sep. 1978 p 1-5 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), no. 4, Jul./Aug. 1978 p 3-6 (For primary document see N78-32672 23-51)
Avail: NTIS HC A07/MF A01

Aircraft noise exposure tests established satisfactory human endurance of acoustic intensities of up to 60 dbA for exposure times of up to 60 days. Continuous exposure to acoustic energy levels of about 75 dbA produced fatigue and decreased efficiency. Specific suggestions are provided for the design of protective antinoise gear in accordance with noise intensity and cumulative exposure time. G.G.

N78-32674# Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF POSSIBILITY OF USING LOWER BODY NEGATIVE PRESSURE TEST FOR SCREENING COSMONAUT CANDIDATES **c52**
Kh. Kh. Yarullin, T. N. Krupina, Yu. M. Svirizhev, T. V. Benevolenskaya, T. D. Vasilyeva, V. I. Asaturyan, and S. L. Kantor *In its* Space Biol. and Aerospace Med., No. 4 (JPRS-71830) 7 Sep. 1978 p 6-13 refs Transl. into ENGLISH of Kosmich. Biol. Aviakosmich. Med. (Moscow), no. 4, Jul./Aug. 1978 p 6-13 (For primary document see N78-32672 23-51)
Avail: NTIS HC A07/MF A01

The reaction of the cardiovascular system to lower body negative pressure was studied by observing vegetovascular disfunctions in males engaged in mental activity. Wellbeing of the subjects and analysis of clinical and physiological examinations were used to assess the functional capabilities of the cardiovascular system and to predict orthostatic endurance. G.G.

N78-32675# Joint Publications Research Service, Arlington, Va.
KALIURETIC RENAL FUNCTION IN MAN AS RELATED TO DIFFERENT DEGREES OF EXERCISE DURING BEDREST **c52**
L. I. Kakurin, G. S. Arzamazov, and A. I. Grigoryev *In its* Space Biol. and Aerospace Med., No. 4 (JPRS-71830) 7 Sep. 1978 p 14-20 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), no. 4, Jul./Aug. 1978 p 13-17 (For primary document see N78-32672 23-51)
Avail: NTIS HC A07/MF A01

Uretic potassium chloride excretion functions of the human kidney were observed during prolonged bed rest and related to varying degrees of motor activity. Results show that substantial changes in potassium transport by the kidneys can be prevented by an optimum regime of exercise and adequate potassium intake with food. G.G.

N78-32676# Joint Publications Research Service, Arlington, Va.
EVALUATION OF REGIONAL BLOOD FILLING BY MEANS OF RHEOPLETHYSMOGRAPHY COMBINED WITH FUNCTIONAL TESTS **c52**
D. G. Maksimov and M. V. Domracheva *In its* Space Biol. and Aerospace Med., No. 4 (JPRS-71830) 7 Sep. 1978 p 21-28 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich Med. (Moscow), no. 4, Jul./Aug. 1978 p 17-23 (For primary document see N78-32672 23-51)
Avail: NTIS HC A07/MF A01

Rheoplethysmography was used to determine the regional reactivity of vessels, their reserve capacity and changes in regional blood filling, as related to simulated space flight conditions. Obtained data are indicative of a correlation between changes in RPLG during functional tests and initial filling of the examined body regions. G.G.

N78-32677# Joint Publications Research Service, Arlington, Va.
DYNAMICS OF FREE AMINO ACID LEVELS IN HUMAN BLOOD PLASMA DURING BED REST IN HEAD DOWN POSITION **c52**
T. F. Vlasova, Ye. B. Miroshnikova, and A. S. Ushakov *In its* Space Biol. and Aerospace Med., No. 4 (JPRS-71830) 7 Sep. 1978 p 29-34 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), no. 4, Jul./Aug. 1978 p 23-27 (For primary document see N78-32672 23-51)
Avail: NTIS HC A07/MF A01

Free amino acid assays of the human blood plasma at different stages of bed rest established a reliable increase during the course of 449-days of head down hypokinesia. Only the concentrations of proline, glycine, and asparic acid remained unchanged. Alanine and glutamic acid concentrations increased during bed rest and continued to increase during the recovery period. It is concluded that changes in human blood plasma aminograms reflect a change in protein metabolism. G.G.

N78-32678# Joint Publications Research Service, Arlington, Va.
PSYCHOPHYSIOLOGICAL DISTINCTIONS OF PILOT PERFORMANCE DURING BRIEF EXPOSURE TO INTENSIVE PHOTIC STIMULI **c54**
V. F. Zhernavkov, L. N. Karelina, and Yu. P. Petrov *In its* Space Biol. and Aerospace Med., No. 4 (JPRS-71830) 7 Sep. 1978 p 35-39 ref Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), no. 4, Jul./Aug. 1978 p 27-31 (For primary document see N78-32672 23-51)
Avail: NTIS HC A07/MF A01

Laboratory studies established that the time within which vision is restored after being blinded by a high powered light source depends on the intensity of the flash, prior adaptation background, and individual resistance to blinding. Repeated exposure to powerful photic stimuli not only had a less deleterious effect on control functions, but diminished psychophysiological tension of the pilot. G.G.

N78-32679# Joint Publications Research Service, Arlington, Va.
PHYSICAL FITNESS OF PERMANENT LOWLAND AND HIGHLAND RESIDENTS **c52**
M. T. Turkmenov and Dzh. I. Imankulov *In its* Space Biol. and Aerospace Med., No. 4 (JPRS-71830) 7 Sep. 1978 p 40-45 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), no. 4, Jul./Aug. 1978 p 31-35 (For primary document see N78-32672 23-51)
Avail: NTIS HC A07/MF A01

The same levels of hemodynamic, pulmonary respiration, and gas exchange were observed among permanent residents of lowlands and highlands of almost the same age and with the same physical development; but vital capacity was smaller in highland residents. Maximum physical efficiency is greater among permanent residents of highlands (by over 16%), and it is implemented with less strain on the cardiovascular system, but greater strain on the respiratory system, as compared to lowland residents. Author

N78-32680# Joint Publications Research Service, Arlington, Va.
METHODS OF IRRADIATING BIOLOGICAL OBJECTS AND RESULTS OF DOSIMETRY ONBOARD THE KOSMOS-690 SATELLITE
Yu. A. Katov, I. V. Ignatov, A. V. Kolodin, R. A. Kuzin, V. I. Popov, L. N. Seliverstov, V. G. Semenov, M. A. Sychkov, and V. V. Yurgov *In its* Space Biol. and Aerospace Med., No. 4 (JPRS-71830) 7 Sep. 1978 p 46-52 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), no. 4, Jul./Aug. 1978 p 35-41 (For primary document see N78-32672 23-51)
Avail: NTIS HC A07/MF A01

Radiophysical studies were used to establish experimental conditions for irradiation of animals and biological objects on Cosmos biosatellite. Thermoluminescent glasses were used to monitor irradiation conditions during inflight experiments.

Radiation hazards were controlled at all stages of the flight experiment which provided about 700 rad per 24 hr exposure from a point source. G.G.

N78-32681# Joint Publications Research Service, Arlington, Va.

HISTOCHEMICAL STUDY OF DIGESTIVE ORGANS OF RATS INVOLVED IN SPACE FLIGHT ON THE KOSMOS-690 SATELLITE

M. G. Shubich, L. L. Goryacheva, V. I. Dudetskiy, N. M. Lutsenko, G. M. Mogilnaya, and V. G. Vlasov *In its* Space Biol. and Aerospace Med., No. 4 (JPRS-71830) 7 Sep. 1978 p 53-58 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), no. 4, Jul./Aug. 1978 p 41-46 (For primary document see N78-32672 23-51)

Avail: NTIS HC A07/MF A01

Morphohistochemical studies on rats after flight or ground based exposures to 220 rad, respectively 600 and 955 rad, were evaluated. Histochemical changes in the stomach and intestine of rats that had flown on a Cosmos biosatellite, as well as those that were exposed to the combined effect of radiation and hypokinesia, are attributed to the development of a systemic adaptation syndrome to stress. G.G.

N78-32682# Joint Publications Research Service, Arlington, Va.

INVESTIGATION OF THE INFLUENCE OF PROLONGED ROTATION ON RADIATION LESIONS c52

Yu. V. Farber, L. A. Tabakova, and A. F. Shafirkin *In its* Space Biol. and Aerospace Med., No. 4 (JPRS-71830) 7 Sep. 1978 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), no. 4, Jul./Aug. 1978 p 46-50 (For primary document see N78-32672 23-51)

Avail: NTIS HC A07/MF A01

Mice exposed to a combination of rotation and radiation showed an intensification of the repair process in the bone marrow and thymus after acute irradiation, as manifested by a reduction in half time for restoration of lymphocytes in peripheral blood, myelokaryocytes, and weight of the gland. G.G.

N78-32683# Joint Publications Research Service, Arlington, Va.

DISTINCTIONS OF RADIOPROTECTIVE EFFECT OF ACUTE HYPOXIA ON 5-DAY-OLD MICE PREADAPTED TO OXYGEN DEFICIENCY

B. Z. Aytmagambetova, A. L. Vygodskaya, Yu. V. Korogodina, E. P. Petrosyan, and S. P. Yarmonenko *In its* Space Biol. and Aerospace Med., No. 4 (JPRS-71830) 7 Sep. 1978 p 65-71 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), no. 4, Jul./Aug. 1978 p 50-54 (For primary document see N78-32672 23-51)

Avail: NTIS HC A07/MF A01

Irradiation experiments on mice demonstrated the radioprotective effects of acute hypoxia and initial oxygen status. The protective effect of hypoxia was much lower in cells cultivated in vivo and irradiated on the 10th to 12th day of tumor growth than in cells cultivated in vitro under normal oxygenation conditions. This decisive protective role of hypoxia is attributed to the intercellular oxygen concentration. G.G.

N78-32684# Joint Publications Research Service, Arlington, Va.

CHANGES IN ELECTROCEREBELLOGRAMS AND AUTONOMIC REACTIONS OF RATS TO ACCELERATIONS

L. D. Klimovskaya and L. S. Ivanenko *In its* Space Biol. and Aerospace Med., No. 4 (JPRS-71830) 7 Sep. 1978 p 72-78 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), no. 4, Jul./Aug. 1978 p 55-59 (For primary document see N78-32672 23-51)

Avail: NTIS HC A07/MF A01

Changes in spontaneous bioelectric activity of the cerebellar cortex in relation to acceleration compensation reactions of the cardiovascular and respiratory systems were studied on rats. Results indicate that the interaction between the proprioceptive analyzer and the autonomic nervous system is an important element in the adaptation mechanism to gravity forces. G.G.

N78-32685# Joint Publications Research Service, Arlington, Va.

ON THE POSSIBLE ROLE OF LYSOSOMAL PROTEINASES IN THE BIOLOGICAL EFFECTS OF ACCELERATIONS c52

V. N. Totskiy and N. D. Khaustova *In its* Space Biol. and Aerospace Med., No. 4 (JPRS-71830) 7 Sep. 1978 p 79-84 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), no. 4, Jul./Aug. 1978 p 60-64 (For primary document see N78-32672 23-51)

Avail: NTIS HC A07/MF A01

Acceleration effects on proteinase activity of liver cell lysosomes under normal conditions and after hydrocortisone injections were studied. Experiments on rats indicate that functional impairment of lysosomes is an early cellular reaction to acceleration stress and that hydrocortisone injection prevents onset of disturbances at the early stages after exposure to acceleration (20 min). G.G.

N78-32686# Joint Publications Research Service, Arlington, Va.

MORPHOLOGICAL STUDY OF HEMOPOIETIC ORGANS OF HYPOKINETIC RATS

I. A. Rakova and V. N. Shvets *In its* Space Biol. and Aerospace Med., No. 4 (JPRS-71830) 7 Sep. 1978 p 85-90 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), no. 4, Jul./Aug. 1978 p 64-68 (For primary document see N78-32672 23-51)

Avail: NTIS HC A07/MF A01

A number of changes occur in the blood system of hypokinetic animals that are typical of the stress reaction: atrophy of the thymus and lymphatic system, lymphopenia, and neutrophilia. These changes are typical in the case of brief stress factors. However, in the presence of hypokinesia, an increase in number of lymphoid cells in bone marrow and discharge of mature granulocytes at the early stage of the reaction, were not observed. In the case of a brief stress factor, the decrease in lymphoid cells occurs primarily in the thymus and only to a small extent in the spleen, whereas in the case of a chronic stress factor it occurs only in the thymus. In the presence of hypokinesia, the decrease in number of these cells is equally significant in the thymus and spleen. Thus, hypokinesia, like other prolonged stimuli, induces the greatest changes in lymphoid organs. The latter may be the cause of impairment of cellular and hymoral immunity, as well as resistance to infection in the organism submitted to prolonged hypokinesia. GRA

N78-32687# Joint Publications Research Service, Arlington, Va.

PROTECTIVE EFFECTS OF 2-AMINOBENZIMIDAZOLE DURING HYPERBARIC OXYGENATION, AND STATE OF CEREBRAL NITROGEN METABOLISM c52

L. G. Mendzheritskaya, A. A. Krichevskaya, and S. A. Lisovskaya *In its* Space Biol. and Aerospace Med., No. 4 (JPRS-71830) 7 Sep. 1978 p 91-95 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), no. 4, Jul./Aug. 1978 p 68-71 (For primary document see N78-32672 23-51)

Avail: NTIS HC A07/MF A01

Administration of 2-ABI prior to exposure to hyperoxia normalized amino acid metabolism in the brain of rats. Metabolic routes in reciprocal conversion of GABA, glutamic and aspartic acids, specifically related to brain functions, were maintained during hyperoxia of 3 and 6 ati. G.G.

N78-32688# Joint Publications Research Service, Arlington, Va.

GOI ANOMALOSCOPES USED TO SET STANDARDS FOR COLOR VISION OF FLIGHT PERSONNEL c52

V. A. Roslyakov *In its* Space Biol. and Aerospace Med., No. 4 (JPRS-71830) 7 Sep. 1978 p 96-97 ref Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), no. 4, Jul./Aug. 1978 p 71-72 (For primary document see N78-32672 23-51)

Avail: NTIS HC A07/MF A01

A method is developed for setting color vision standards and for determining standards of color discrimination in relative units by representing the ratio of reading magnitude to the mean reading level norm on anomaloscopes. G.G.

N78-32689# Joint Publications Research Service, Arlington, Va.

EFFECTS OF WEIGHTLESSNESS AND HYPOKINESIA ON CONTRACTILITY OF BUNDLES OF GLYCERIN-TREATED RAT MUSCLE FIBERS

M. S. Gayevskaya, I. I. Ivanov, N. V. Karsanov, N. B. Gabadze, V. A. Megaldadze, N. P. Mikhaleva, and Ye. A. Nosova *In its* Space Biol. and Aerospace Med., No. 4 (JPRS-71830) 7 Sep. 1978 p 98-101 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), no. 4, Jul./Aug. 1978 p 72-74 (For primary document see N78-32672 23-51)

Avail: NTIS HC A07/MF A01

The effects of weightlessness and prolonged hypokinesia on contractile function of myofibrils of rat skeletal muscles were studied after the animals had been on a 22 day space flight or kept immobile for 50 days. The contractile properties of bundles of glycerin-treated muscle fibers were used to determine onset of pathological disturbances directly in the protein complex of the myofibril system. G.G.

N78-32690# Joint Publications Research Service, Arlington, Va.

DEVELOPMENT OF RADIATION LESIONS TO THE RAT HEART DURING A SPACE FLIGHT (EXPERIMENTAL MORPHOLOGICAL STUDY)

A. S. Kaplanskiy and G. N. Durnova *In its* Space Biol. and Aerospace Med., No. 4 (JPRS-71830) 7 Sep. 1978 p 102-105 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), no. 4, Jul./Aug. 1978 p 74-76 (For primary document see N78-32672 23-51)

Avail: NTIS HC A07/MF A01

A severe decline in phosphorylase A and B activity and increase in beta-oxybutyrate dehydrogenase activity were found on the 12th day after irradiation in the myocardium of the absolute majority of rats in the flight group and animals in the ground-based model experiments, whereas some increase in activity of alpha-glycerophosphate dehydrogenase not bound with NAD was demonstrated only in 50 percent of the rats examined. Histological changes in the myocardium were mostly the result of acute hypoxia, which ocurred when the animals were exsanguinated. G.G.

N78-32691# Joint Publications Research Service, Arlington, Va.

EFFECTS OF ALTERED GRAVITY ON VISCOSITY OF CYTOPLASM AND PROTEIN CONTENT OF PLANT CELLS

M. G. Tairbekov and A. N. Rozov *In its* Space Biol. and Aerospace Med., No. 4 (JPRS-17830) 7 Sep. 1978 p 106-113 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosm. Med. (Moscow), no. 4, Jul./Aug. 1978 p 76-77 (For primary document see N78-32672 23-51)

Avail: NTIS HC A07/MF A01

Physicochemical studies on geotropic reactions of corn cells to altered gravity and weightlessness conditions indicate a nonuniform distribution of cell organelles in cytoplasm due to impaired circulation. G.G.

N78-32692# Joint Publications Research Service, Arlington, Va.

ELECTROLYTE CONTENT OF THE MYOCARDIUM, SKELETAL MUSCLES AND BLOOD OF RATS DURING PROLONGED HYPOKINESIA AND READAPTION

N. P. Mikhaleva, G. D. Yefimenko, and I. P. Bobrovnitskiy *In its* Space Biol. and Aerospace Med., No. 4 (JPRS-71830) 7 Sep. 1978 p 114-116 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), no. 4, Jul./Aug. 1978 p 80-81 (For primary document see N78-32672 23-51)

Avail: NTIS HC A07/MF A01

The distribution of potassium and sodium was studied in rat organs and tissues in the course of hypokinesia and the recovery period. The most marked changes were demonstrated in the potassium content of the tissues. It decreased in the myocardium and skeletal muscle, and this was more marked and occurred at an earlier time than the decrease in potassium level in plasma and erythrocytes. G.G.

N78-32693# Joint Publications Research Service, Arlington, Va

REGIONAL REDISTRIBUTION OF BLOOD DURING THE IMMEDIATE AFTEREFFECT PERIOD FOLLOWING EXPOSURE OF RATS TO TRANSVERSE ACCELERATIONS

O. A. Kovalev, V. N. Grishanov, S. K. Sheremetevskaya, and O. N. Nepochatov *In its* Space Biol. and Aerospace Med., No. 4 (JPRS-71830) 7 Sep. 1978 p 117-118 ref Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), no. 4, Jul./Aug. 1978 p 82 (For primary document see N78-32672 23-51)

Avail: NTIS HC A07/MF A01

Radioactive tracer methods were used to demonstrate changes in relative and absolute blood content of rat organs, tissues and in different parts of the body. Quantitative processing of obtained data shows that transverse acceleration changed regional distribution circulation through passive mobilization of a small amount of blood from capacitance vessels of skeletal muscles of the abdomen and pelvis minor. G.G.

N78-32694# Joint Publications Research Service, Arlington, Va.

EFFECT OF CORIOLIS ACCELERATIONS ON MAN'S ABILITY TO DETERMINE THE DIRECTION OF GRAVITATIONAL VERTICAL **c54**

O. A. Vorobyev and A. A. Gyurozhian *In its* Space Biol. and Aerospace Med., No. 4 (JPRS-71830) 7 Sep. 1978 p 119-123 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), no. 4, Jul./Aug. 1978 p 83-85 (For primary document see N78-32672 23-51)

Avail: NTIS HC A07/MF A01

The link between degree of vestibulovegetative manifestations and the extent of deviation of the subjective vertical from the true one was studied with the subject's position constantly vertical in relation to the gravitation vector. Poorer results obtained with subjects that were more susceptible to motion sickness did not offer a correlation between resistance to motion sickness and capacity for spatial orientation. G.G.

N78-32695# Joint Publications Research Service, Arlington, Va.

EFFECT OF THE COMBINATION OF DRY AIR HEAT AND COLD WATER TREATMENT ON HUMAN ORTHOSTATIC STABILITY **c52**

V. V. Zhidkov, V. V. Borschchenko, and G. A. Manovtsev *In its* Space Biol. and Aerospace Med., No. 4 (JPRS-71830) 7 Sep. 1978 p 124-128 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), no. 4, Jul./Aug. 1978 p 85-87 (For primary document see N78-32672 23-51)

Avail: NTIS HC A07/MF A01

Hot and cold procedures, consisting of 40-45 min of heat (65 plus or minus 3 C) followed by cold water rubs (20 plus or minus 3 C), lead to some decline, 40 min later, in reaction of the circulatory system to the orthosatatic test and two hours later, to substantial improvement in endurance of orthostatic test. G.G.

N78-32696# Joint Publications Research Service, Arlington, Va.

DYNAMICS OF AFFERENT IMPULSATION IN POSTERIOR SPINAL RADICES OF DOGS WITH RESTRICTED MOVEMENT

S. A. Skuratova, V. S. Oganov, M. A. Shirvinskaya, and V. S. Magedov *In its* Space Biol. and Aerospace Med., No. 4 (JPRS-71830) 7 Sep. 1978 p 129-132 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), no. 4, Jul./Aug. 1978 p 88-89 (For primary document see N78-32672 23-51)

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A synchronization of bioelectrical activity of the posterior spinal radices was observed on the 30th day of limited mobility of dogs. Such a change in overall afferent impulsation under the influence of hypokinesia could be due to elimination of some proprioceptors (articular, tendonal, musculocutaneous) from activity as a result of substantial decrease in movements made by the animal. This is confirmed by a decline of overall motor activity at the end of the experiment. G.G.

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N78-32697 Purdue Univ., Lafayette, Ind.
AUDITORY FREQUENCY SELECTIVITY AND TWO-TONE SUPPRESSION IN NORMAL HEARING HUMAN LISTENERS Ph.D. Thesis
Honor OMalley 1977 135 p
Avail: Univ. Microfilms Order No. 7813097

A qualitative relationship between two-tone suppression and auditory frequency selectivity is presented. Threshold masking curves and two-tone masking patterns were collected under two conditions for the same normal hearing listeners using an adaptive two-alternative forced choice forward masking procedure. In the quiet conditon, the data were gathered in the presence of a noise floor. In the noise condition, a narrowband noise masker, centered one decade down from the probe, was gated on with the tonal masker(s). The mutually-reflected changes in masking curves and in two-tone suppression as a consequence of the gated noise masker indicate a close relationship between frequency selectivity and suppression: the greater the magnitude of suppression above the center frequency of the masking curve, the sharper the tuning of the masking curve. Dissert. Abstr.

N78-32698 Columbia Univ. Teachers Coll., New York.
THE RELATIONSHIP BETWEEN COMFORTABLE LOUDNESS RANGE AND MOST COMFORTABLE LOUDNESS FOR PURE TONES AND SPEECH IN SENSORINEURAL HEARING LOSS Ph.D. Thesis
Voldie Osmond McCarthy 1978 164 p
Avail: Univ. Microfilms Order No. 7812012

Using Bekesy audiometry, comfortable loudness range (CLR) and most comfortable loudness (MCL) data for pure tones and speech were obtained for 60 male subjects with sensorineural hearing losses. Each subject performed six experimental tasks namely upper limit of comfortable loudness range (ULNLR), lower limit of comfortable loudness range (LLCLR) and MCL for speech and for pure tones. Means and standard deviations of CLR and MCL for pure tones and speech for the 60 subjects were determined and classified into two subgroups--mild and moderate to moderately severe. The results revealed that, in general, mean CLRs for pure tones and speech tended to decrease as hearing loss becomes poorer. Also, the sensation level of MCL for both stimuli is affected by the severity of hearing loss at threshold. Furthermore, as hearing loss becomes poorer at threshold, MCL appears to get closer to LLCLR. Dissert. Abstr.

N78-32699# Civil Aeromedical Inst., Oklahoma City, Okla.
THREE REPORTS RELEVANT TO STRESS IN AVIATION PERSONNEL
E. A. Higgins, M. T. Latogola, and C. E. Melton Feb. 1978 36 p refs Sponsored by FAA
(AD-A051690; FAA-AM-78-5) Avail: NTIS HC A03/MF A01 CSCL 06/5

Methods for simulating and monitoring aviation stress in air traffic controllers and pilots are evaluted. Areas included are: cardiovascular and pulmonary parameters, altitude exposure, visual accomodation, blood drug level, internal body temperature, gastrointestinal pathology, and comparisons of previously studied controller subjects. For individual titles, see N78-32700 through N78-32702.

N78-32700# Civil Aeromedical Inst., Oklahoma City, Okla.
DEVELOPMENT OF THE AVIATION STRESS PROTOCOL: SIMULATION AND PERFORMANCE, PHYSIOLOGICAL, AND BIOCHEMICAL MONITORING SYSTEMS, PHASE 1
In its Three Rept. Relevant to Stress in Aviation Personnel Feb. 1978 16 p refs (For primary document see N78-32699 23-52)
Avail: NTIS HC A03/MF A01 CSCL 06/5

Aviation personnel were exposed to various types of simulated physiological stress. The results were used in the development of the aviation stress protocol-simulation. Conclusions are given concerning the folowing: cardiovascular testing, time of exposure to altitude, internal body temperature, blood drug level, and blood glucose. S.B.S.

N78-32701# Civil Aeromedical Inst., Oklahoma City, Okla.
ASSESSMENT OF CARDIOVASCULAR FUNCTION AFTER EXPOSURE TO THE AVIATION STRESS PROTOCOL: SIMULATION
In its Three Rept. Relevant to Stress in Aviation Personnel Feb. 1978 9 p (For primary document see N78-32699 23-52)
Avail: NTIS HC A03/MF A01 CSCL 06/5

Thirty-six air traffic controller subjects from previous stress studies were identified who subsequently suffered medical conditions severe enough to require waiver or retirement. These subjects' stress indices were compared with those of subjects who had no known pathology to see if any of the stress indicators were predictive of pathological conditions. High levels of steriod excretion are related to the presence or later development of gastrointestinal disease, the most common stress related disease. The principal subcategories are related to ulceration of the stomach and duodenum. S.E.S.

N78-32702# Civil Aeromedical Inst., Oklahoma City, Okla.
THE RELATIONSHIP BETWEEN STRESS-RELATED METABOLITES AND DISQUALIFYING PATHOLOGY IN AIR TRAFFIC CONTROL PERSONNEL
In its Three Rept. Relevant to Stress in Aviation Personnel Feb. 1978 9 p refs (For primary document see N78-32699 23-52)
Avail: NTIS HC A03/MF A01 CSCL 06/5

Cardiovascular tests were administered immediately following the aviation stress protocol-simulation (ASPS) to identify any functional deterioration due to the ASPS exposure. These post-ASPS cardiovascular tests were assessed. A complete set of ASPS altitude exposures was achieved on a total of 10 normal male subjects. The results of the tests show (1) statically significant altitude-related displacements in physiological parameters; and (2) the cardiovascular tests are to run parallel rather than in tandem with the core ASPS. S.E.S.

N78-32703*# National Aeronautics and Space Administration, Washington, D. C.
THE EFFECT OF DIRECT HEATING AND COOLING OF HEAT REGULATION CENTERS ON BODY TEMPERATURE
Henry Gray Barbour Sep. 1978 33 p refs Transl. into ENGLISH from Naunyn-Schmiedebergs Arch. Pharmakol. Exp. Pathol. (West Germany), v. 70, 1912 p 1-26 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Vienna Univ.
(Contract NASw-3199)
(NASA-TM-75450) Avail: NTIS HC A03/MF A01 CSCL 06P

Experiments were done on 28 rabbits in which puncture instruments were left in the brain for 1-2 days until the calori-puncture hyperthermia had passed and the body temperature was again normal. The instrument remaining in the brain was then used as a galvanic electrode and a second fever was produced, this time due to the electrical stimulus. It was concluded that heat is a centrally acting antipyretic and that cold is a centrally acting stimulus which produces hyperpyrexia cold-induced fever. Author

N78-32704*# National Aeronautics and Space Administration, Washington, D. C.
THE CORRELATION OF SODIUM AND POTASSIUM METABOLISM WITH THE LEVEL OF ENERGY CONSUMPTION IN MAN DURING ADAPTATION TO HEAT
B. G. Afanasyev and V. A. Zhestovskiy Jul. 1978 13 p refs Transl. into ENGLISH from Gigiena i Sanit. (USSR), v. 36, no. 6, 1971 p 32-37 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Dept. of Naval Hygiene of the S.M. Kirov Military Medicine Academy, Leningrad
(NASA-TM-75331) Avail: NTIS HC A02/MF A01 CSCL 06S

The sodium and potassium metabolism was studied in a thermal chamber at 35 deg and 80 percent relative humidity in 8 men for a period of 6 days. The control group (3 subjects) were outside of the chamber at a comfortable ambient temperature. The intracellular sodium and potassium metabolism were assessed based on their content in the erythrocytes. The finding was that during adaptation to heat, a considerable amount of sodium was excreted by the body in the sweat and urine (about 1/3 of the sodium content of the human body) as compared with its intake and the amount of potassium retained in the body. Changes in the concentration of sodium and potassium

may serve as indexes of the state of adaptation processes during constant exposure to heat. Author

N78-32705# Civil Aeromedical Inst., Oklahoma City, Okla.
THREE-DIMENSIONAL ANTHROPOMETRY OF THE ADULT FACE
J. W. Young and M. S. Pinski Mar. 1978 40 p refs
(AD-A054938; FAA-AM-78-14) Avail: NTIS HC A03/MF A01 CSCL 05/5

A new three-dimensional anatomical axis system is described that is based on four conventional anthropometrical face landmarks. Coincident as a coordinate (orthogonal) axis system, this reference system was developed to provide convenient orientation of the head segment and any surface landmark in three-dimensional space for direct comparisons with subject population. Forty-four anthropometric landmarks on the face and adjacent areas are defined and measured on 30 adult female and male test subjects participating in a study to evaluate protective breathing equipment. These data provide a basic data base for test subject selections, dimensional correlations of face types with equipment performance, and preliminary design criteria (gross structure dimensions) for dummy test devices and protective-type breathing equipment. Individual sets of data points for each subject are presented in tabular format for the convenience of data use. G.G.

N78-32706# Civil Aeromedical Inst., Oklahoma City, Okla.
THE EFFECTS OF ALTITUDE AND TWO DECONGESTANT-ANTIHISTAMINE PREPARATIONS ON PHYSIOLOGICAL FUNCTIONS AND PERFORMANCE
E. A. Higgins, W. D. Chiles, J. M. McKenzie, A. E. Jennings, G. E. Funkhouser, and S. R. Mullen Apr. 1978 15 p refs
(AD-A054793; FAA-AM-78-19) Avail: NTIS HC A02/MF A01 CSCL 06/15

Fourteen men were studied to determine the combined effects of two altitudes ground level (1,274 ft) and (12,500 ft), and three preparations lactose placebo, Compound A (Actifed), and Compound B (Dristan). Physiological data show that A was a stimulant and B a depressant. Subjects reported least subjective attentiveness with A and greatest with lactose. Significant time effects were evident in subjective ratings (increasing fatigue and decreasing energy, interest, and attentiveness). The Multiple Task Performance Battery (MTPB) showed no effects of altitude, drugs, or time on overall performance; however, performance declined from the first to the second hour in several tasks, while problem solving improved. The data are compatible with reported decreasing interest and attentiveness. Results from physiological parameters and some subjective evaluations indicate that time after ingestion and type of compound ingested are important. G.G.

N78-32707# Civil Aeromedical Inst., Oklahoma City, Okla.
CARDIORESPIRATORY ASSESSMENT OF DECONGESTANT-ANTIHISTAMINE EFFECTS ON ALTITUDE, +Gz, AND FATIGUE TOLERANCES
Michael T. Lategola, Audie W. Davis, Jr., Peggy J. Lyne, and Mary J. Burr Apr. 1978 26 p refs
(AD-A055089; FAA-AM-78-20) Avail: NTIS HC A03/MF A01 CSCL 06/15

Decongestants and antihistamines are known to produce effects capable of adversely modifying physiological function and psychomotor task performance. Because of relevance to safe pilot performance, the effects of single doses of two decongestant-antihistamine preparations (Compound A and Compound B), or a placebo on cardiorespiratory responses to two equally space +2Gz tests during separate 2-hour exposures at ground level (GL) (1,274 ft MSL) and 12,500 ft chamber altitude were assessed. Postaltitude fatigue was assessed by cardiorespiratory responses to submaximal bicycle ergometry. Compound A and Compound B appeared to exert no significant detrimental effects on short-duration postaltitude ergometric fatigability. All combinations of medication, altitude, and +Gz were well tolerated. G.G.

N78-32708# Civil Aeromedical Inst., Oklahoma City, Okla.
AEROMEDICAL IMPLICATIONS OF THE X-CHROM LENS FOR IMPROVING COLOR VISION DEFICIENCIES
Kenneth W. Welsh, John A. Vaughan, and Paul G. Rasmussen Apr. 1978 23 p refs
(AD-A054794; FAA-AM-78-22) Avail: NTIS HC A02/MF A01 CSCL 06/12

The X-Chrom contact lens is a recent device recommended to improve defective color vision. The red lens is usually worn on the nondominant eye and may require extended wearing for optimum color vision enhancement. A battery of tests was given to 24 individuals, 12 with normal and 12 with defective color vision. While wearing X-Chrom lenses, subjects had significantly improved scores on standard clinical pseudoisochromatic plate tests, including the Hardy-Rand-Rittler, Ishihara, and Dvorine plates. Data indicated that color identification scores using the Farnsworth Lantern, Color Threshold Tester, and the Aviation Signal Light Gun were not significantly different for evaluations made with and without the X-Chrom lens. Minimal changes were found on several tests including the Farnsworth D-15, aeronautical chart color identification task, Holmgren Yarn, visual acuity, phorias, and stereoscopic depth perception. The majority of control and experimental subjects noted a change in the perceived path of the swinging pendulum while viewing through a monocular red filter or an X-Chrom lens, respectively. G.G.

N78-32709# Franklin Inst. Research Labs., Philadelphia, Pa. Dept. of Science Information Services.
A LITERATURE REVIEW: PROBLEM DEFINITION STUDIES ON SELECTED TOXIC CHEMICALS. VOLUME 4: OCCUPATIONAL HEALTH AND SAFETY ASPECTS OF THE FOG OILS SGF NO. 1 AND SGF NO. 2 AND SMOKE SCREENS GENERATED FROM THEM Final Report, Mar. 1977 - Apr. 1978
Deborah Liss-Suter, Jon E. Villaume, and Paul N. Craig Apr. 1978 162 p refs
(Contract DAMB17-77-C-7020; DA Proj. 3E7-62720-A-835) (AD-A055903) Avail: NTIS HC A08/MF A01 CSCL 06/20

Literature is reviewed (144 references) on the following subjects: physico-chemical properties generation of fog oil smoke; human toxicity, occupational hazards and associated health and safety practices and standards; toxicological investigations in animals including mice, rats, guinea pigs, hamsters, monkeys, rabbits, dogs, cats and calves; absorption, distribution, metabolism and excretion in mammals; methods of sampling and determining atmospheric fog oil smoke, and extraction and determination of oils in biologic media. The two fog oils, SGF No. 1 and SGF No. 2, are both refined petroleum products. SGF No. 1 is representative of fuels (similar to fuel oils No. 1 and No. 2 and light grades of diesel fuel), while SGF No. 2 is a lubricating oil (related to light automotive and industrial lubricating oils and mineral oils). The two fog oils have different viscosities, distillation ranges, flash points, and different hydrocarbon compositions, among others. Both oils are used in smoke generators, which vaporize the oils and force the vapors into the atmosphere, where they condense into a dense white smoke screen consisting of oil microdroplets. Effects of continuous exposure of U.S. Army personnel to fog oil smoke screens, for weeks on end, have not been documented. GRA

N78-32710# Science Applications, Inc., Arlington, Va.
BIOCYBERNETICS EXPERIMENT: COMMAND AND CONTROL HUMAN FACTORS EXPERIMENTAL PROGRAM Final Report, Oct. 1976 - Sep. 1977
T. Bevan 19 Jan. 1978 58 p
(Contracts N00014-77-C-0107; MDA903-77-C-0119) (AD-A055666; SAI-78-727-WA) Avail: NTIS HC A04/MF A01 CSCL 05/8

On the basis of on-site job analyses conducted at several national military C3 centers, message sorting was identified as both a highly critical center function and as a man-machine task amenable to future online biocybernetic applications. Consequently, the experiment reported here simulated a computer-assisted message handling task and was designed to manipulate the difficulty of that task in order to identify EEG correlates of low, medium and high task difficulty. Author (GRA)

N78-32711# National Technical Information Service, Springfield, Va.
ALTITUDE HYPOXIA. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - May 1978
Elizabeth A. Harrison May 1978 254 p Supersedes NTIS/PS-77/0446, NTIS/PS-76/0378 and NTIS/PS-75/237

(NTIS/PS-78/0443; NTIS/PS-77/0446; NTIS/PS-76/0378; NTIS/PS-75/237) Avail: NTIS HC $28.00/MF $28.00 CSCL 06S

The selected abstracts of research reports cover stress physiology, narcosis, acceleration tolerance, adaptation (physiology), psychophysiology, respiration, metabolism and cardiovascular system as applied to altitude hypoxia. (This updated bibliography contains 247 abstracts, 11 of which are new entries to the previous edition.) GRA

N78-32712# National Technical Information Service, Springfield, Va.

TOXICITY OF GASEOUS HALOGENATED ORGANIC COMPOUNDS. A BIBLIOGRAPHY WITH ABSTRACTS Final Report, 1964 - Jun. 1978

Pernell W. Crockett Jun. 1978 298 p Supersedes NTIS/PS-77/0521; NTIS/PS-76/0132; NTIS/PS-75/387; COM-73-11881 (NTIS/PS-78/0600/3; NTIS/PS-77/0521; NTIS/PS-76/0132; NTIS/PS-75/387; COM-73-11881) Avail: NTIS HC $28.00/MF $28.00 CSCL 06T

Subject areas including toxicological studies on halogenated hydrocarbons used as industrial chemicals, fire extinguishers, anesthetics, solvents, pesticides, and aerosol propellants are presented. (This updated bibliography contains 292 abstracts, 114 of which are new entries to the previous edition.) Author

N78-32713# Auerbach Associates, Inc., Philadelphia, Pa.

ACRYLONITRILE Final Monograph

Jerome T. Maddock, Wendy L. Byer, Roger T. Malseed, John Keresztesy, Thomas J. Taylor, and Arthur Katz 17 Dec. 1977 110 p refs

(Contract CPSC-C-76-0067)

(PB-280478/9; AAI-2383/2384-700-TR-3) Avail: NTIS HC A06/MF A01 CSCL 06T

The literature regarding acrylonitrile was reviewed and attempts were made to determine the potential risk associated with the exposure of the U.S. consumer to products prepared from acrylonitrile. Acrylonitrile was rated very toxic although its toxic mechanism remains in dispute. Evidence indicates its possible carcinogenicity in occupationally exposed populations. However, consumer exposure to the acrylonitrile monomer is extremely rare, occurring at present only in textile fibers manufactured in such a way as to provide no exposure to the consumer. GRA

N78-32714# Mitre Corp., McLean, Va. Metrek Div.

AIR POLLUTION ASSESSMENT OF VINYLIDENE CHLORIDE Final Report

J. Hushon and M. Kornreich Apr. 1978 82 p

(Contract EPA-68-02-1495)

(PB-280624/8; MTR-7230) Avail: NTIS HC A05/MF A01 CSCL 06T

Chronic exposure to low levels of vinylidene chloride can result in liver and kidney damage. Vinylidene chloride is a central nervous system depressant reported to have a narcotic effect. Mutagenicity of vinylidene chloride in micro-organisms indicates a need for investigation of its carcinogenicity. The population at risk due to vinylidene chloride exposure is composed primarily of workers in industrial or commercial operations manufacturing or using it. Airborne emissions of vinylidene chloride are not likely to pose a significant risk to the general population. Emissions during production, storage, and transport can be controlled by methods similar to those planned for control of vinyl chloride. GRA

N78-32715# Environmental Research Lab., Narragansett, R.I.

ANNOTATED BIBLIOGRAPHY ON BIOLOGICAL EFFECTS OF METALS IN AQUATIC ENVIRONMENTS, 3D

Ronald Eisler, Janiel J. ONeill, Jr., and Glen W. Thompson Jan. 1978 496 p refs

(PB-280953/1; EPA-600/3-78-005; NO-1293-2246) Avail: NTIS HC A21/MF A01 CSCL 06T

Titles of 954 technical articles are listed on the subject of toxicological, physiological and metabolic effects of stable and radio-labelled chemical species of metal cations to marine, estuarine and freshwater flora and fauna. Each reference was annotated and subsequently indexed by metal, by taxa, and by author, in cumulative indices which encompass this volume and the initial volumes in this series. GRA

N78-32674# Joint Publications Research Service, Arlington, Va.

INVESTIGATION OF POSSIBILITY OF USING LOWER BODY NEGATIVE PRESSURE TEST FOR SCREENING COSMONAUT CANDIDATES

Kh. Kh. Yarullin, T. N. Krupina, Yu. M. Svirizhev, T. V. Benevolenskaya, T. D. Vasilyeva, V. I. Asaturyan, and S. L. Kantor *In its* Space Biol. and Aerospace Med., No. 4 (JPRS-71830) 7 Sep. 1978 p 6-13 refs Transl. into ENGLISH of Kosmich. Biol. Aviakosmich. Med. (Moscow), no. 4, Jul./Aug. 1978 p 6-13 (For primary document see N78-32672 23-51)

Avail: NTIS HC A07/MF A01

N78-32675# Joint Publications Research Service, Arlington, Va.

KALIURETIC RENAL FUNCTION IN MAN AS RELATED TO DIFFERENT DEGREES OF EXERCISE DURING BEDREST

L. I. Kakurin, G. S. Arzamazov, and A. I. Grigoryev *In its* Space Biol. and Aerospace Med., No. 4 (JPRS-71830) 7 Sep. 1978 p 14-20 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), no. 4, Jul./Aug. 1978 p 13-17 (For primary document see N78-32672 23-51)

Avail: NTIS HC A07/MF A01

N78-32676# Joint Publications Research Service, Arlington, Va.

EVALUATION OF REGIONAL BLOOD FILLING BY MEANS OF RHEOPLETHYSMOGRAPHY COMBINED WITH FUNCTIONAL TESTS

D. G. Maksimov and M. V. Domracheva *In its* Space Biol. and Aerospace Med., No. 4 (JPRS-71830) 7 Sep. 1978 p 21-28 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich Med. (Moscow), no. 4, Jul./Aug. 1978 p 17-23 (For primary document see N78-32672 23-51)

Avail: NTIS HC A07/MF A01

N78-32677# Joint Publications Research Service, Arlington, Va.

DYNAMICS OF FREE AMINO ACID LEVELS IN HUMAN BLOOD PLASMA DURING BED REST IN HEAD DOWN POSITION

T. F. Vlasova, Ye. B. Miroshnikova, and A. S. Ushakov *In its* Space Biol. and Aerospace Med., No. 4 (JPRS-71830) 7 Sep. 1978 p 29-34 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), no. 4, Jul./Aug. 1978 p 23-27 (For primary document see N78-32672 23-51)

Avail: NTIS HC A07/MF A01

N78-32679# Joint Publications Research Service, Arlington, Va.

PHYSICAL FITNESS OF PERMANENT LOWLAND AND HIGHLAND RESIDENTS

M. T. Turkmenov and Dzh. I. Imankulov *In its* Space Biol. and Aerospace Med., No. 4 (JPRS-71830) 7 Sep. 1978 p 40-45 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), no. 4, Jul./Aug. 1978 p 31-35 (For primary document see N78-32672 23-51)

Avail: NTIS HC A07/MF A01

N78-32682# Joint Publications Research Service, Arlington, Va.

INVESTIGATION OF THE INFLUENCE OF PROLONGED ROTATION ON RADIATION LESIONS

Yu. V. Farber, L. A. Tabakova, and A. F. Shafirkin *In its* Space Biol. and Aerospace Med., No. 4 (JPRS-71830) 7 Sep. 1978 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), no. 4, Jul./Aug. 1978 p 46-50 (For primary document see N78-32672 23-51)

Avail: NTIS HC A07/MF A01

N78-32685# Joint Publications Research Service, Arlington, Va.

ON THE POSSIBLE ROLE OF LYSOSOMAL PROTEINASES IN THE BIOLOGICAL EFFECTS OF ACCELERATIONS

V. N. Totskiy and N. D. Khaustova *In its* Space Biol. and Aerospace Med., No. 4 (JPRS-71830) 7 Sep. 1978 p 79-84 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich.

Med. (Moscow), no. 4, Jul./Aug. 1978 p 60-64 (For primary document see N78-32672 23-51)
Avail: NTIS HC A07/MF A01

N78-32687# Joint Publications Research Service, Arlington, Va.
PROTECTIVE EFFECTS OF 2-AMINOBENZIMIDAZOLE DURING HYPERBARIC OXYGENATION, AND STATE OF CEREBRAL NITROGEN METABOLISM
L. G. Mendzheritskaya, A. A. Krichevskaya, and S. A. Lisovskaya *In its* Space Biol. and Aerospace Med., No. 4 (JPRS-71830) 7 Sep. 1978 p 91-95 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), no. 4, Jul./Aug. 1978 p 68-71 (For primary document see N78-32672 23-51)
Avail: NTIS HC A07/MF A01

N78-32688# Joint Publications Research Service, Arlington, Va.
GOI ANOMALOSCOPES USED TO SET STANDARDS FOR COLOR VISION OF FLIGHT PERSONNEL
V. A. Roslyakov *In its* Space Biol. and Aerospace Med., No. 4 (JPRS-71830) 7 Sep. 1978 p 96-97 ref Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), no. 4, Jul./Aug. 1978 p 71-72 (For primary document see N78-32672 23-51)
Avail: NTIS HC A07/MF A01

N78-32695# Joint Publications Research Service, Arlington, Va.
EFFECT OF THE COMBINATION OF DRY AIR HEAT AND COLD WATER TREATMENT ON HUMAN ORTHOSTATIC STABILITY
V. V. Zhidkov, V. V. Borschchenko, and G. A. Manovtsev *In its* Space Biol. and Aerospace Med., No. 4 (JPRS-71830) 7 Sep. 1978 p 124-128 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), no. 4, Jul./Aug. 1978 p 85-87 (For primary document see N78-32672 23-51)
Avail: NTIS HC A07/MF A01

N78-33033# Joint Publications Research Service, Arlington, Va.
POLISH COSMONAUT SELECTION PROCESS DESCRIBED
Stanislaw Remuszko *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 45 (JPRS-71673) 14 Aug. 1978 p 24-26 Transl. into ENGLISH from Slowo Powszechne (Warsaw), 28 Jun. 1978 p 3 (For primary document see N78-33030 23-99)
Avail: NTIS HC A04/MF A01

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N78-32716# Civil Aeromedical Inst., Oklahoma City, Okla.
EXPERIMENTAL ATTEMPTS TO EVOKE A DIFFERENTIAL RESPONSE TO DIFFERENT STRESSORS
C. E. Melton, J. M. McKenzie, J. T. Saldivar, and S. M. Wicks Apr. 1978 7 p refs
(AD-A054795; FAA-AM-78-18) Avail: NTIS HC A02/MF A01 CSCL 06/16

Ten paid male subjects each worked at a physical task with no competitive element (treadmill) and a competitive task (Pong) with minimal physical activity. There were three work periods, each 50 min long. Ten minutes were allowed for rest and urine collection after each work period. The experimental period lasted 3 hr. Urine was analyzed for 17 ketogenic steroids (17-KGS), epinephrine (E), and norepinephrine (NE). Heart rates were derived from ambulatory electrocardiograms. There were no statistically significant differences in excretion of urinary metabolites during corresponding episodes of the two tasks. Heart rates were significantly higher during treadmill work than during Pong playing. Rest-to-work differences in excretion of 17 KGS and NE are not significant. The rest-to-work increase in heart rate is significant for treadmill, but not for Pong. The increase in epinephrine excretion strengthens the conclusion drawn from field experiments that this measurement is the best indicator of the intensity of air traffic control work per se. Author

N78-32717*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EFFECT OF VIBRATION DURATION ON HUMAN DISCOMFORT
Sherman A. Clevenson, Thomas K. Dempsey, and Jack D. Leatherwood Sep. 1978 26 p refs
(NASA-TP-1283; L-12248) Avail: NTIS HC A03/MF A01 CSCL 05H

The duration effects of random vertical vibration on passenger discomfort were studied in a simulated section of an aircraft cabin configured to seat six persons in tourist-class style. Variables of the study included time of exposure (0.25 min to 60 min) and the rms amplitude of vibration (0.025g to 0.100g). The vibrations had a white noise spectrum with a bandwidth of 10 Hz centered at 5 Hz. Data indicate that the discomfort threshold occurred at an rms vertical acceleration level of 0.027g for all durations of vibration. However, for acceleration levels that exceeded the discomfort threshold, a systematic decrease in discomfort occurred as a function of increasing duration of vibration. For the range of accelerations used, the magnitude of the discomfort decrement was shown to be independent of acceleration level. The results suggest that discomfort from vertical vibration applied in the frequency range at which humans are most sensitive decreases with longer exposure. which is the opposite of the recommendation of the International Standard ISO 2631-1974 (E) Guide for the Evaluation of Human Exposure to Whole-Body Vibration. A.R.H.

N78-32718# Air Force Human Resources Lab., Brooks AFB, Tex.
AREA OF INTEREST/FIELD-OF-VIEW RESEARCH USING ASPT Interim Report, Oct. 1976 - Dec. 1977
W. Dean LeMaster and Thomas M. Longridge, Jr. May 1978 22 p refs
(AD-A055692; AFHRL-TR-78-11) Avail: NTIS HC A02/MF A01 CSCL 01/4

Two exploratory experiments were conducted in the Advanced Simulator for Pilot Training to examine the head-slaved area of interest (AOI) approach for reduced fields-of-view employing computer-generated imagery (CGI). The objective of Study 1 was to establish a suitable range of AOI sizes for simulated conventional gunnery range bombing performance. The results indicated an AOI size as small as 70 vertical x 90 deg. horizontal could be usefully employed without seriously degrading bombing performance. The objective of Study 2 was to determine the effect of AOI level of detail on air-to-surface weapon delivery performance in a tactical environment. Study 2 also addressed the question of whether AOI size affected bombing performance in such an environment. No effects on bombing performance of either detail level, AOI size or their interaction were observed. It was concluded from both studies that an AOI size as small as 70 x 90 is feasible for the head-slaved AOI approach. Further research on required detail level is needed.Author (GRA)

N78-32719# Civil Service Commission, Washington, D.C. Personnel Research and Development Center.
STABILITY OF CHARACTERISTICS OF ALTERNATE FORMS OF A TEST BATTERY Final Report
Hilda Wing Aug. 1977 12 p
(PB-280958/0; TM-77-7) Avail: NTIS HC A02/MF A01 CSCL 05J

The stability of a test battery across different test forms and different test-taker groups was investigated. The characteristics scrutinized were the reliabilities of the components of the battery, their intercorrelations, and the reliabilities of the composite total scores. The reliabilities, both of the subtests and the composites, were stable as were all but one group of intercorrelations. An explanation for this exception is not readily available. GRA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N78-32720* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

CONDITION SENSOR SYSTEM AND METHOD Patent

John T. Polhemus, Joseph E. Morgan, and Arthur Mandell, inventors (to NASA) Issued 30 May 1978 6 p Filed 21 May 1976 Supersedes N76-26448 (14 -17, p 2189)
(NASA-Case-MSC-14805-1; US-Patent-4,092,633; US-Patent-Appl-SN-688856; US-Patent-Class-340-213R; US-Patent-Class-340-262; US-Patent-Class-340-279; US-Patent-Class-340-285; US-Patent-Class-340-309.1) Avail: US Patent Office CSCL 05H

The condition sensor system comprises a condition detector which produces a pulse when a parameter of the monitored condition exceeds a desired threshold. A resettable condition counter counts each pulse. A resettable timer is preset to produce a particular time frame. The counter produces a condition signal when the accumulated number of pulses within the time frame is equal to or greater than a preset count. Control means responsive to the incoming pulses and to the condition signal produce control signals that control utilization devices. After a suitable delay, the last detected pulse simultaneously resets the pulse counter and the timer, and prepares them for sensing another condition occurrence within the time frame. The invention has particular utility in the process of detecting rocking motions of blind people. A controlled, audible, bio-feedback signal is provided which constitutes a warning to the blind person that he is rocking.
Official Gazette of the U.S. Patent Office

N78-32721* National Aeronautics and Space Administration, Washington, D. C.

COOLING SYSTEM FOR REMOVING METABOLIC HEAT FROM AN HERMETICALLY SEALED SPACESUIT Patent

Bruce W. Webbon, Hubert C. Vykukal, and Bill A. Williams, inventors (to NASA) Issued 20 Jul. 1978 8 p Filed 23 Dec. 1976 Supersedes N77-14743 (15 - 05, p 0661)
(NASA-Case-ARC-11059-1; US-Patent-4,095,593; US-Patent-Appl-SN-753978; US-Patent-Class-128-142.7; US-Patent-Class-62-259) Avail: US Patent Office CSCL 06Q

An improved cooling and ventilating system is described for removing metabolic heat, waste gases and water vapor generated by a wearer of an hermetically sealed spacesuit. The cooling system was characterized by a body suit, having a first circuit for simultaneously establishing a cooling flow of water through the thorax and head sections of the body suit. Circulation patches were included mounted in the thorax section and head section of the body suit. A second circuit for discharing a flow of gas throughout the spacesuit and a disconnect unit for coupling the circuits with a life support system externally related to the spacesuit were provided.
Official Gazette of the U.S. Patent Office

N78-32722# Civil Aeromedical Inst., Oklahoma City, Okla.

THE RELATIONSHIP OF PREDEVELOPMENTAL 150 TRAINING WITH NONCOMPETITIVELY SELECTED AIR TRAFFIC CONTROL TRAINEES TO FAA ACADEMY SUCCESS

James O. Boone Mar. 1978 25 p refs
(AD-A055009; FAA-AM-78-10) Avail: NTIS HC A02/MF A01 CSCL 05/9

Past studies have demonstrated that women and minorities are less likely to be selected as FAA air traffic controllers than are nonminority men, and, when selected, are less likely to be successful. One major reason for this is that women and minorities have less aviation-related background experience. The predevelopmental program was begun to give those selected for the program a 1 year orientation to aviation and air traffic control prior to FAA Academy training. The unique relationship between predevelopmental training and Academy success was studied. An overview of the relationships between various background characteristics, selection measures, predevelopmental training measures, and Academy measures was first computed. Then, through path analysis the significant relationships were considered simultaneously to determine the unique relationship between predevelopmental training and Academy success. The path models indicated that predevelopmental training overall does enhance a trainee's potential for Academy success with a possible differential effect according to minority status. G.G.

N78-32723# Department of Transport and Civil Aviation, Melbourne (Australia). Aviation Medicine Branch.

PULL FORCE CAPABILITIES FOR PARACHUTE RIPCORD RELEASE

Margaret I. Bullock (Queensland Univ., Brisbane, Australia) Nov. 1977 52 p refs
(Memo-33) Avail: NTIS HC A04/MF A01

The pull force capabilities of female parachutists in positions relevant to ripcord release were assessed. Pull forces which can be exerted for period of 0.25, 1, 1.5, 2 and 2.5 seconds during a 5 second pull are presented in percentile form. The relatively low level of strength exhibited by the weakest groups of the population emphasizes the need for such basic information in equipment design. G.G.

N78-32724*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

PNEUMATIC INFLATABLE END EFFECTOR Patent Application

Keith H. Clark and James D. Johnston, inventors (to NASA) 22 Sep. 1978 11 p
(NASA-Case-MFS-23696-1; US-Patent-Appl-SN-945044) Avail: NTIS HC A02/MF A01 CSCL 05H

An invention is presented which relates to an end effector for use on the end of a remotely controlled manipulator arm of a robot or teleoperator device. The end effector grasps an object by being inflated after insertion into an open area of the object. Novelty of the invention is believed to reside in the use of a balloon-type inflatable end member for a remote manipulator and in the spline and reinforced sections of the balloon. NASA

N78-32725# Los Alamos Scientific Lab., N. Mex.

RESPIRATOR SELECTION

Darrel D. Douglas 1978 14 p refs Presented at Can. Conf. on Personal Protect. Equipment, Toronto, 23 Jan. 1978
(Contract W-7405-eng-36)
(LA-UR-78-119; Conf-780115-1) Avail: NTIS HC A02/MF A01

Some basic guidelines in respirator selection are given to assist those who must set up a respirator program. Guidelines for respirator selection are contained in the OSHA/NIOSH respirator decision logic, a document intended for OSHA/NIOSH use in determining respirator requirements for regulations. The guidelines given here are meant for use by those who must prescribe respiratory protection and do not have specific regulations for guidance. For this purpose many of the guidelines in the OSHA/NIOSH decision logic will be used. After consideration of the basic information necessary for selection, the use of respirator selection tables is discussed. ERA

N78-32678# Joint Publications Research Service, Arlington, Va.

PSYCHOPHYSIOLOGICAL DISTINCTIONS OF PILOT PERFORMANCE DURING BRIEF EXPOSURE TO INTENSIVE PHOTIC STIMULI

V. F. Zhernavkov, L. N. Karelina, and Yu. P. Petrov *In its* Space Biol. and Aerospace Med., No. 4 (JPRS-71830) 7 Sep. 1978 p 35-39 ref Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), no. 4, Jul./Aug. 1978 p 27-31
(For primary document see N78-32672 23-51)
Avail: NTIS HC A07/MF A01

N78-32694# Joint Publications Research Service, Arlington, Va.

EFFECT OF CORIOLIS ACCELERATIONS ON MAN'S ABILITY TO DETERMINE THE DIRECTION OF GRAVITATIONAL VERTICAL

O. A. Vorobyev and A. A. Gyurozhian *In its* Space Biol. and Aerospace Med., No. 4 (JPRS-71830) 7 Sep. 1978 p 119-123 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), no. 4, Jul./Aug. 1978 p 83-85 (For primary

document see N78-32672 23-51)
Avail: NTIS HC A07/MF A01

N78-33018# Joint Publications Research Service, Arlington, Va.
FIFTY MINUTE IN HYDRAULIC WEIGHTLESSNESS
A. Khorobrykh *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 42 (JPRS-71612) 3 Aug. 1978 p 54-60 Transl. into ENGLISH from Aviat. Kosmonavt. (Moscow), no. 6, 1978 p 36-37 (For primary document see N78-33015 23-99)
Copyright. Avail: NTIS HC A05/MF A01

N78-33034# Joint Publications Research Service, Arlington, Va.
DEVELOPMENT OF MODERN SPACESUITS
G. Ilin, V. Ivanov, and I. Pavlov *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 45 (JPRS-71673) 14 Aug. 1978 p 27-38 Transl. into ENGLISH from Nauka Zhizn (Moscow), no. 6, 1978 p 40-46 (For primary document see N78-33030 23-99)
Copyright. Avail: NTIS HC A04/MF A01

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

N78-32136# Maryland Univ., College Park. Lab. of Chemical Evolution.
LIFE BEYOND THE EARTH
Cyril Ponnamperuma *In* Indian Inst. of Sci. Space Sci., Technol. and Appl.: An Overview Apr. 1978 6 p Repr. from Astronaut. and Aeronaut., Nov. 1976 6 p (For primary document see N78-32114 23-12)
Avail: NTIS HC A10/MF A01

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering*.

N78-32726 California Univ., Berkeley.
EXECUTION TIME ANALYSIS FOR REAL-TIME MICROCOMPUTER PROGRAMS Ph.D. Thesis
Fay Chong, Jr. 1977 268 p
Avail: Univ. Microfilms Order No. 7812519

In many computer applications, the amount of time required to execute a program is as critical as the correctness of the computation. The adjective 'real-time' usually prefaces the names of the computer components used in such applications; thus one speaks of real-time systems, real-time programs, etc. Some tools for the development and analysis of real-time programs are presented, including a programming language and a technique for evaluating and testing worst-case program execution times. The most outstanding feature of this analysis technique is that the source program structure is preserved during translation. The real-time programming language called PLRTMC (Programming Language for Real-Time Microcomputers) is presented. The intermediate object code is analyzed by the execution time analysis program. Dissert. Abstr.

N78-32727 California Univ., Berkeley.
DISTRIBUTED COMPUTER SYSTEMS: PROBLEMS AND TRENDS Ph.D. Thesis
Torben Moller 1977 224 p
Avail: Univ. Microfilms Order No. 7812699

The implications of the declining cost of computer hardware, especially processors, are examined with respect to the architecture of distributed systems and the user environment. A design of a distributed system is developed, centered around the concepts of modularization along functional boundaries, high-level implementation-independent interfaces, and limited user-knowledge of physical implementation. The reasons for considering distributed systems are presented, both in relation to existing applications and to applications made possible through use of distribution. A number of current and past computer systems are presented, with emphasis on the parts which show applications of functional distribution. The methods for use in analysis and design of distributed systems are described. A design for a distributed system is presented. Applications of the techniques from a distributed system are discussed. Dissert. Abstr.

N78-32728 Rice Univ., Houston, Tex.
SYNTAX DIRECTED ERROR ANALYSIS IN AUTOMATICALLY CONSTRUCTED PARSERS Ph.D. Thesis
Thomas Evans Shields 1978 184 p
Avail: Univ. Microfilms Order No. 7814801

A nondeterministic error detecting syntax analysis algorithm was constructed from context-free grammar. This extended parsing algorithm depends only on the particular grammar for its definition of an error. A construction for practical extended parsers using techniques derived from the general algorithm is presented which is based on the canonical LR(k) parser construction. This construction yields an efficient approximation to the general extended parser in the sense that the parser may have accessible nondeterministic configurations which are handled by the same mechanism as are error configurations for the purpose of achieving deterministic behavior. Heuristic methods of improving this approximation by reducing or eliminating the chances of entering a nondeterministic configuration are suggested; in many cases the resulting parser is able to perform as well as the general algorithm. Dissert. Abstr.

N78-32729*# National Aeronautics and Space Administration, Washington, D. C.
APPLICATION OF THE INFORMATIONAL REFERENCE SYSTEM OZhUR TO THE AUTOMATED PROCESSING OF DATA FROM SATELLITES OF THE KOSMOS SERIES
V. M. Pokras, V. P. Yevdokimov, and V. D. Maslov Oct. 1978 20 p refs Transl. into ENGLISH of "Primeneniya Informatsionno Spravochnoy Sistemy OZhUR dlya Avtomatizirovannoy Obrabotki Dannykh Sputnikov Serii Kosmos", Rept. PR-392 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1978 p 1-20 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75558; PR-392) Avail: NTIS HC A02/MF A01 CSCL 05B

The structure and potential of the information reference system OZhUR designed for the automated data processing systems of scientific space vehicles (SV) is considered. The system OZhUR ensures control of the extraction phase of processing with respect to a concrete SV and the exchange of data between phases. The practical application of the system OZhUR is exemplified in the construction of a data processing system for satellites of the Cosmos series. As a result of automating the operations of exchange and control, the volume of manual preparation of data is significantly reduced, and there is no longer any need for individual logs which fix the status of data processing. The system Ozhur is included in the automated data processing system Nauka which is realized in language PL-1 in a binary one-address system one-state (BOS OS) electronic computer. J.M.S.

N78-32730*# National Aeronautics and Space Administration, Washington, D. C.
FAST PROCESSING OF DATA FROM SNEG-2MP EXPERIMENT

I. I. Dumer, G. I. Zabiyakin, A. V. Kuznetsov, V. A. Krylov, A. N. Lutoshkin, O. A. Magarshak, L. V. Onishchenko, V. M. Olkhov, G. L. Pakhomov, S. N. Rykovanov et al Sep. 1978 15 p refs Transl. into ENGLISH of "Ekspress-Obrabotka Informatsii Eksperimenta Sneg-2MP", Rept. PR-391 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1978 p 1-15 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by USSR Academy of Sci.
(Contract NASw-3199)
(NASA-TM-75547; PR-391) Avail: NTIS HC A02/MF A01 CSCL 05B

The following subjects are covered: Basic stages during computer processing of data from Sneg-2MP instrument, basic modes during separation and fast processing (separation of data during satellite flight, separation of burst data segments, sampling and analysis of initial burst data segment). Experimental results obtained on the basis of fast processed data are reported.
Author

N78-32731*# Technology Development Corp., Sunnyvale, Calif.
THE ILLIAC IV MEMORY SYSTEM: CURRENT STATUS AND FUTURE POSSIBILITIES
David Stevenson 8 May 1978 142 p Prepared in cooperation with Lear Siegler, Inc., Santa Monica, Calif. and Computer Sci. Corp., Los Angeles
(Contracts NAS2-8870; NAS2-8728; NAS2-9359)
(NASA-CR-152177) Avail: NTIS HC A07/MF A01 CSCL 09B

The future needs of researchers who will use the Illiac were examined and the requirements they will place on the memory system were evaluated. Various alternatives to replacing critical memory components were considered with regard to cost, risk, system impact, software requirements, and implementation schedules. The current system, its performance and status, and the limitations it places on possible enhancements are discussed as well as the planned enhancements to the Illiac processor. After a brief technology survey, different implementations are presented for each system memory component. Three different memory systems are proposed to meet the identified needs of the Illiac user community. These three alternatives differ considerably with respect to storage capacity and accessing capabilities, but they all offer significant improvements over the current system. The proposed systems and their relative merits are analyzed.
A.R.H.

N78-32732# Naval Postgraduate School, Monterey, Calif.
A MICROCOMPUTER BASED PLASMA DISPLAY SYSTEM M.S. Thesis
Ordale Paul Babin, Jr. and Ronald Ray Seaman Mar. 1978 301 p refs
(AD-A055426) HC A14/MF A01 CSCL 09/2

An overview of plasma display technology and operation is presented. Advantages and disadvantages of plasma graphics are explored. Some applications that are particularly appropriate for a plasma display are listed. Hardware and software developed to interface the AN/UYQ-10 plasma display with an Intellec Microcomputer Development System are discussed.
Author (GRA)

N78-32733# Naval Ship Research and Development Center, Bethesda, Md.
THE SHARP DATA BASE MANAGEMENT SYSTEM: USER INFORMATION MANUAL
Ben Wallis, Roy Hyde, and Teri Blake Aug. 1976 208 p refs
(AD-A055581; DTNSRDC-TM-188-76-1) Avail: NTIS HC A10/MF A01 CSCL 09/2

SHARP (Ships Analysis and Retrieval Program) is a self-contained generalized Data Base Management System developed and operational on DTNSRDC's CDC 6700 SCOPE 3.4 computer system. Data bases may be constructed, maintained, and queried interactively from remote terminals. English-like user oriented languages are used for data base definition, report definition, and query specifications. SHARP is also operational on the IBM 370, UNIVAC 70/45, UNIVAC 1108, and NOVA ECLIPSE computers.
GRA

N78-32734# Naval Underwater Systems Center, New London, Conn.
A COMPARISON OF TACTICAL MILITARY AND COMMERCIAL DATA PROCESSING COMPUTER ARCHITECTURAL REQUIREMENTS
Lynn A. DeNoia and Robert L. Gordon 23 May 1978 35 p refs
(AD-A055975; NUSC-TR-5783) Avail: NTIS HC A03/MF A01 CSCL 09/2

It is shown that tactical military data processing need not be different from commercial data processing in terms of the computer architectural features required to support applications programs. The general lack of specific performance data from execution of operational tactical programs makes it difficult to evaluate architectural issues with current military computers or to compare future candidates; however, sufficient data are available to develop general conclusions concerning computer architectures. It is recommended that the military capitalize on currently available commercial computer architectures and keep careful track of commercial research and development efforts.
Author (GRA)

N78-32735# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
REALIZATION OF ANALOG-TO-DIGITAL CODERS Interim Report
Steven N. Jones Mar. 1978 21 p refs
(Grant AF-AFOSR-3281-77)
(AD-A055909; ESL-TM-817; AFOSR-78-1031TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

A new theory of direct finite-level digital control may lead to more efficient implementations and better performance. Unfortunately, the mathematics of conversion of coding continuous waveforms into finite-level waveforms (acceptable to computer) is not well understood. Ultimately we want to understand the interaction of continuous and digital feedback, since new insights may be gained in the design of digital controllers. But before systematic design procedures can be found, we must thoroughly understand the interaction of digital machines with continuous plants through the coding and decoding processes. As a preliminary mathematical model we can assume each element on the feedback loop can be represented as a functional mapping from the set of all possible input waveforms to the set of all output waveforms. For a meaningful theory the class of input and output waveforms and the kind of functionals between them must be restricted to reflect the properties of physical elements themselves.
Author (GRA)

N78-32736# Naval Ocean Systems Center, San Diego, Calif.
MODULAR FAST FOURIER TRANSFORM PROCESSOR Final Report, Jan. 1976 - Apr. 1977
R. E. Johnson and A. L. Heaberlin 3 Nov. 1977 77 p refs
(AD-A055680; NOSC/TR-178) Avail: NTIS HC A05/MF A01 CSCL 09/2

A 1024-point, 16-bit, 20-ms, Fast Fourier Transform Processor (FFTP), using Standard Electronic Module (SEM) design philosophy, SEM R and D modules, and supporting mechanical hardware was designed and fabricated. The FFTP has two data input ports. One accepts data from a minicomputer (PDP-11); the other accepts data from an analog-to-digital converter. Two output ports, one digital and one analog, are also available for interfacing.
Author (GRA)

N78-32737# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
CONFIGURATION SPACE CONTROL
Berthold K. P. Horn Dec. 1977 39 p refs
(Contract N00014-77-C-0389)
(AD-A055668; AI-M-458) Avail: NTIS HC A03/MF A01 CSCL 09/2

Complicated systems with nonlinear time-varying behavior are difficult to control using classical linear feedback methods applied separately to individual degrees of freedom. At the present, mechanical manipulators, for example, are limited in their rate of movement by the inability of traditional feedback systems to deal with time-varying inertia, torque coupling effects between links and Coriolis forces. Analysis of the dynamics of such systems, however, provides the basic information needed to achieve adequate control. Implementation of a control system based on such analysis is not straightforward, however, since

impractical amounts of computation or memory may be called. A new method that balances the trade-off between computation and storage costs is proposed. The actuator torques required to move a manipulator along a trajectory are calculated using coefficients found in a look-up table indexed by the configuration of the manipulator. Feedback plays only an indirect role in correcting for small differences between the state of the actual device and that of a dynamic model. GRA

N78-32738# Environmental Research Inst. of Michigan, Ann Arbor.

INVESTIGATIONS OF THE PHOTOCONDUCTOR-THERMOPLASTIC IMAGE TRANSDUCER Final Scientific Report, 1 Jan. - 31 Dec. 1977

Willis S. Colburn May 1978 54 p refs

(Contract F44620-76-C-0053)

(AD-A055508; ERIM-119500-2-F; AFOSR-78-1043TR) Avail: NTIS HC A04/MF A01 CSCL 09/2

A basic research effort was performed to investigate the use of the photoconductor-thermoplastic (PTP) recording medium as an incoherent-to-coherent transducer that serves as a real-time input device for an optical data processor. The principle of operation of the PTP recording medium is reviewed with a brief discussion of nonlinearities. Experimental investigations of the write-time, repetitive writing, resolution, response to a CRT input, and addition of an integral grating are described. Using parallel plane charging, write cycles (charge, expose, and develop) were carried out in less than 10 msec. With the thermoplastic biased at an elevate temperature, repetitive recording was demonstrated at a rate of 2.5 cycles/sec. The PTP transducer was incorporated into an advanced optical processor that used holographic optics to form a lightweight real-time optical data processor. The photoplastic transducer is characterized by good exposure sensitivity, high resolution, and simple construction. Because development and erasure occur only upon deliberate application of heat, the transducer is well suited to applications that require image retention before and during readout. Regardless of the spectral sensitivity of the photoconductor, readout can be at any wavelength. Author (GRA)

N78-32739# Massachusetts Inst. of Tech., Cambridge. Center for Information Systems Research.

A SYSTEMATIC APPROACH TO DESIGNING COMPLEX SYSTEMS. AN APPLICATION TO SOFTWARE OPERATING SYSTEMS

Timothy A. Holden Jun. 1978 224 p refs

(Grant N00039-78-G-0160)

(AD-A055481; CISR-TR-5; CISR-P010-7805-05) Avail: NTIS HC A10/MF A01 CSCL 09/2

This document reports additional experience gained in the use of the system design methodology being developed in this project. The target system under study here is the software for a small computer operating system. Requirement specification statements are developed from published descriptions of the purpose and approach underlying the operating system. Interrelationships between requirements are developed according to the guidelines specified in the earlier research efforts. The decomposition methodology is then applied to the graph representation of the design problem, design subproblems and their interrelationships are analyzed. Finally, the results of the design generated using the formal methodology are compared to the actual operating system. Insights and experiences gained in the use of the design methodology, are discussed throughout. Author (GRA)

N78-32740# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

MIME: MICROPROGRAMMABLE MINICOMPUTER EMULATOR M.S. Thesis

Richard E. Purvis and Ronald D. Yoho Mar. 1978 224 p refs

(AD-A055522; AFIT/GE/EE/78-6) Avail: NTIS HC A10/MF A01 CSCL 09/2

This report addresses the design and fabrication of a microprogrammable, general purpose minicomputer specifically configured for use in an educational environment (AFIT's Digital Engineering Laboratory). In order to have utility as an instructional aid in the areas of computer control and microprogramming, it was determined that such a machine must have the following attributes: educationally oriented human interface, educationally oriented design, and user-microprogrammability. These high level attributes were then used as a basis for deriving functional and detail requirements. The Am2900 Bipolar Microprocessor Family was used as the basis for realizing the design which satisfied the defined requirements. The project resulted in hardware which was used by students in digital engineering classes and laboratory to investigate microprogramming and its application to emulation. This report includes representative microcode necessary to emulate sample PDP-11/03 instructions as a demonstration of MIME capabilities. GRA

N78-32741# University of Southern Calif., Marina del Rey. Information Sciences Inst.

MULTI-MICROPROCESSOR EMULATION Annual Report (Final) for 1977

Charles Hayden, Peter W. Alfvin, and Stephen D. Crocker Apr. 1978 38 p refs

(Contract DAHC15-72-C-0308; ARPA Order 2223)

(AD-A055527; ISI/SR-78-12) Avail: NTIS HC A03/MF A01 CSCL 09/2

The goal of the Multi-Microprocessor Emulation (MMPE) project is to develop modeling and emulation techniques for assemblies of microprocessors. An extension to an existing computer description language (ISPS) is proposed for representing the architecture of multi-microprocessor systems, and the results of some preliminary studies on the design of an emulation facility are described. This effort will eventually lead to a high-speed emulation facility based on the QPRIM system. The emulation facility is one component of the SAEF under development at RADC. Author (GRA)

N78-32742# Woods Hole Oceanographic Institution, Mass.

A DIGITAL TAPE FORMAT FOR WOODS HOLE OCEANOGRAPHIC INSTITUTION CTD DATE

R. C. Millard, A. Blumer, and N. Galbraith May 1978 43 p refs

(Contract N00014-76-C-0197; NR Proj. 083-400)

(AD-A055833; WHOI-78-43) Avail: NTIS HC A03/MF A01 CSCL 09/2

A new digital data tape format has been developed to be used for data from the WHOI/Brown CTD microprofiler. CTD-78 Version 1 as detailed in this report is designed as a flexible and expandable internal data format adapted to the Hewlett-Packard 2100/21MX series 16-bit mini-computers currently used to transcribe and process CTD data at sea. The ten record types presently used in this multifile tape format store CTD and associated water sample data and the labeling information needed to convert the data to physical units. Record types are identified by unique keywords. Author (GRA)

N78-32743# National Technical Information Service, Springfield, Va.

MICROCOMPUTERS: DESIGN AND SOFTWARE DEVELOPMENT. CITATIONS FROM THE NTIS DATA BASE Final Report, 1964 - May 1978

George W. Reimherr Jun. 1978 202 p NTIS/PS-77/0325; NTIS/PS-76/0202; and NTIS/PS-75/251

(NTIS/PS-78/0610/2; NTIS/PS-77/0325; NTIS/PS-76/0202; NTIS/PS-75/251) Avail: NTIS HC $28.00/MF $28.00 CSCL 09B

This bibliography contains 196 abstracts. The design of microcomputers and the development of its software are covered. Studies on microcomputer applications are included only if the above topics are cited. Circuit and chip technology, reliability, and performance evaluation are included. GRA

N78-32744# National Computer Center, Research Triangle Park, N. C.

EPA EXECUTIVE SEMINAR ON DATABASE MANAGEMENT SYSTEMS

David F. McAllister, ed. (North Carolina State Univ.) 1977 98 p Seminar held 25-26 Oct. 1977

(PB-281248/5) Avail: NTIS HC A05/MF A01 CSCL 09B

The objective of the EPA executive seminar was to acquaint EPA management with database management systems (DBMS) and how they can help the Federal Manager. Topics included the following: What can DBMS do for the Federal Manager;

Organization considerations for successful DBMS; Case studies of DBMS; and are DBMS objectives achievable. Author

N78-32148*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
UNIBUS MONITOR FOR PDP 11
M. D. Donner *In its* The Deep Space Network 15 Aug. 1978 p 70-12 (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 09B

N78-33016# Joint Publications Research Service, Arlington, Va.
STANDARD DATA PROCESSING MEANS IN COBOL AND PL-1
Lyudmila Petrovna Babenko *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 42 (JPRS-71612) 3 Aug. 1978 p 18-29 Transl. into ENGLISH from Upravlyayushchiye Sist. i Mashiny (Kiev), no. 2, Mar. - Apr. 1978 p 59-62 (For primary document see N78-33015 23-99)
Copyright. Avail: NTIS HC A05/MF A01

N78-33022# Joint Publications Research Service, Arlington, Va.
NEED TO EXPAND USE OF COMPUTERS DISCUSSED
P. I. Chebayevskiy *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 43 (JPRS-71652) 9 Aug. 1978 p 1-4 Transl. into ENGLISH from Dengi i Kredit (Moscow), no. 3, 1978 p 33-35 (For primary document see N78-33021 23-99)
Copyright. Avail: NTIS HC A04/MF A01

N78-33031# Joint Publications Research Service, Arlington, Va.
CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY
I. Karimov and I. Soliyev *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 45 (JPRS-71673) 14 Aug. 1978 p 4-11 Transl. into ENGLISH from Vestn. Statist. (Moscow), no. 5, 1978 p 62-67 (For primary document see N78-33030 23-99)
Copyright. Avail: NTIS HC A04/MF A01

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N78-32745 North Carolina State Univ. at Raleigh
MECHANICAL SEPARATION PHENOMENA IN ELASTIC SYSTEMS WITH DETERMINISTIC AND STOCHASTIC EXCITATION Ph.D. Thesis
Nitin Jesingbhai Shah 1978 93 p
Avail: Univ. Microfilms Order No. 7811626

The phenomenon of dynamic mechanical separation in elastic systems is investigated. A formal analytical approach for the consideration of separation phenomena in elastic systems is developed. The physical criterion that establishes the onset of separation phenomenon in elastic systems is that the minimum contact force between the structure and its support is zero. Subjected to this criterion, several problems with different types of loading and boundary conditions, including stochastic excitation are investigated. Specific separation design equations giving the condition of impending separation are developed. Numerical results are obtained with the aid of the computer. These results are presented graphically and their significance is discussed in terms of both the singular and interrelated effects of the individual system parameters on the impending separation phenomenon.
Dissert Abstr.

N78-32746 Stanford Univ., Calif.
THE KINEMATIC DESIGN AND FORCE CONTROL OF COMPUTER CONTROLLED MANIPULATORS Ph.D. Thesis
Bruce Edward Shimano 1978 142 p
Avail: Univ. Microfilms Order No. 78-14207

The research presented concerns two problems involving mechanical manipulators which are operated under computer control: (1) the design and analysis of the structural parameters of manipulators with respect to their affect on work space, and (2) the real time control of manipulators using force feedback. The techniques currently used to sense forces and to force servo a manipulator are reviewed. A set of equations which can be employed to resolve the readings from a force sensing wrist into a force and torque acting at a arbitrary point is developed and a completely automatic method for calibrating a force sensing wrist is presented. Lastly, a new technique for controlling the forces applied by a manipulator is described. Dissert. Abstr.

N78-32747 California Univ., Berkeley.
EXCEPTION PROCESSING IN COMPUTER SYSTEMS Ph.D. Thesis
Bruce Gilbert Lindsay 1977 226 p
Avail: Univ. Microfilms Order No. 78-12661

An exception processing facility operating in an environment of cooperating, but mutually suspicious subsystems is developed. The exception facility is driven by exception signals from the failed operating and is responsible for selecting and activating a handler for the exception. It also manages the resumption of normal processing when the handler terminates. An implementation of the exception processing facility is presented. The implementation is partitioned into a set of low level operations for initiating and terminating exception episodes, and a subsystem which manages the selection and activation of the handler. An interesting aspect of the implementation is the ability of the exception processing subsystem to process its own exceptions using the same handler specification and selection protocols which are used for normal exceptions. Dissert. Abstr.

N78-32748 Pennsylvania State Univ., University Park.
LOCAL CONSTRAINTS IN THE SYNTAX AND SEMANTICS OF PROGRAMMING LANGUAGES Ph.D. Thesis
Kang Yueh 1978 157 p
Avail: Univ. Microfilms Order No. 7816375

The method of local constraints describes context-free languages in an apparently context-sensitive form which helps to retain the intuitive insights about the grammatical structures. The ALGOL 60 syntax is restated as a grammar with local constraints, and the parsing is carried out by a suitable extension of Earley's algorithm. Methods are described which convert a given context-free grammar to an equivalent local constraints grammar and conversely. The relationship of local constraints to the semantics of programs is discussed by considering the Knuth-type semantics. Dissert. Abstr.

N78-32749 Oregon State Univ., Corvallis.
ON SEQUENTIAL/PARALLEL MATRIX ARRAY LANGUAGES Ph.D. Thesis
Patrick Shen-Pei Wang 1978 69 p
Avail: Univ. Microfilms Order No. 7815694

A new system called sequential/parallel matrix grammars for two-dimensional pattern processing is introduced and studied. Miscellaneous language operations such as union, catenation (row and column), Kleen's closure (row and column) and substitutions were investigated. The equivalence of sequential/parallel matrix languages and finite-turn repetitive checking automata was established. Hierarchies for both languages and machines were also found. Also given are regular-like expressions and array grammars that describe sets of matrices or rectangular arrays with fixed proportions. Finally, several related future research topics are mentioned. Dissert Abstr.

N78-32750 Yale Univ., New Haven, Conn.
A MODEL OF THE UNDERSTANDABILITY OF COMPUTER PROGRAMS Ph.D. Thesis
John Spencer Rugaber 1977 248 p
Avail: Univ. Microfilms Order No. 7817151

Computer programs are notoriously hard to read. Some of the factors include program length, complexity of control flow, scope of variable names, and inter-variable data dependency. An abstract machine model is developed that allows consistent and intuitive measurements of these factors to be made. The model was used to analyze examples taken from the literature of programming methodology. The results correspond to the qualitative observations made by programming theorists.
Dissert Abstr.

N78-32751*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DESCRIPTION OF A FORTRAN SUBROUTINE FOR PLOTTING THREE-DIMENSIONAL DATA
Michael R. James and Wendell W. Kelley Aug. 1978 29 p refs
(NASA-TM-78772) Avail: NTIS HC A03/MF A01 CSCL 09B

A FORTRAN subroutine is described which provides the capability to plot three-dimensional data on an interactive cathode-ray-tube computer terminal or conventional plotter. The plotted data, which must be described in terms of a series of two-dimensional curves, appeared to form a surface in three-dimensional space. Features are included of the subroutine's capability for hidden-line computations. User instructions and sample programs are described. Author

N78-32752*# National Aeronautics and Space Administration, Washington, D. C.
FUNDAMENTAL SOLUTION OF THE PROBLEM OF LINEAR PROGRAMMING AND METHOD OF ITS DETERMINATION
S. V. Petrunin Oct. 1978 16 p refs Transl. into ENGLISH of "Fundamentalnoye Resheniye Zadachi Lineynogo Programmirovanniya i Metod Yego Opredeleniya", Rept. PR-389, Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1978 p 1-15 Transl. by SCITRAN, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75556; PR-389) Avail: NTIS HC A02/MF A01 CSCL 09B

The idea of a fundamental solution to a problem in linear programming is introduced. A method of determining the fundamental solution and of applying this method to the solution of a problem in linear programming is proposed. Numerical examples are cited. Author

N78-32753# SRI International Corp., Menlo Park, Calif.
DECIDING LINEAR INEQUALITIES BY COMPUTING LOOP RESIDUES Interim Report
Robert Shostak 10 Mar. 1978 20 p refs
(Contracts F44620-73-C-0068; F30602-78-C-0031; Grant NSF MCS-76-81425)
(AD-A055868; AFOSR-78-1095TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

The real and integer feasibility of sets of linear inequalities of the form x - or - y - c can be decided quickly by examining the loops in certain graphs. The method is generalized first to real feasibility of inequalities in two variables and arbitrary coefficients, and ultimately to real feasibility of arbitrary sets of linear inequalities. The method is well suited to applications in program verification. GRA

N78-32754# Softech, Inc., Waltham, Mass.
OPERATIONAL SOFTWARE CONCEPT OSC EXECUTIVE EVALUATION/REFINEMENT Final Technical Report, Sep. - Dec. 1976
Michael G. Willoughby and Carl K. Hitchon Aug. 1977 178 p
(Contract F33615-76-C-1192)
(AD-A055902; AFAL-TR-77-87) Avail: NTIS HC A09/MF A01 CSCL 09/2

This report describes executives built using the Operational Software Concept (OSC). These executives are designed to operate on a federated network of four DAIS processors connected by DAIS multiplex data busses. In fact, the executives and applications, represented by stubs, have been implemented on a two processor system. The applications supported by the executives are specified using Directed Flowgraphs (DFG) as described in AD-A010 415. This report is divided into three sections and an appendix. The first section describes the process of building an executive based on a DFG. The second section describes the parameters affecting system performance that are associated with the DFG supported by the executives. The third section presents the baseline executive statistics, tuning method descriptions and statistics for the final tuned executive. The appendix provides program listings of intermediate tuning results of the final tuned executives. GRA

N78-32755# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
THE DESIGN AND ANALYSIS OF ALGORITHMS FOR ASYNCHRONOUS MULTIPROCESSORS Interim Report
Gerard M. Baudet Apr. 1978 190 p refs
(Contract N00014-76-C-0370; Grant NSF MCS-75-222-55)
(AD-A055823; CMU-CS-78-116) Avail: NTIS HC A09/MF A01 CSCL 09/2

The characteristic of an asynchronous multiprocessor is that it is composed of several processors capable of carrying out the execution of their own programs in a completely independent fashion. As a consequence, parallel algorithms for asynchronous multiprocessors present some unique aspects in both their design and their analysis. This thesis explores the issues raised by the design and the analysis of parallel algorithms for asynchronous multiprocessors and illustrates the various notions and concepts involved with these algorithms by considering problems in diverse areas. The thesis demonstrates that asynchronous multiprocessors can be used efficiently in different problem domains, provided that appropriate algorithms are used. It also illustrates various techniques useful in the analysis of such algorithms. As evidenced by a series of experimental results, the computation time required by a process to execute several instances of the same task on an asynchronous multiprocessor cannot be regarded as constant and is actually subject to important fluctuations. These fluctuations in computation times have a negative effect on the performance of parallel algorithms when several processes cooperating in the solution of a problem communicate extensively among themselves. In this case, when synchronization is used, it tends to introduce a prohibitive overhead which decreases the parallelism. On the other hand, an algorithm is presented to illustrate that the fluctuations are not always a negative factor but can also be utilized advantageously. GRA

N78-32756# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science and Mathematics.
AN INTRODUCTION TO ALGORITHM DESIGN Interim Report
Jon Louis Bentley May 1978 28 p refs
(Contract N00014-76-C-0370)
(AD-A055819; CMU-CS-78-121) Avail: NTIS HC A03/MF A01 CSCL 09/2

The field of algorithm design is concerned with the development of efficient methods for solving computational problems. Although the field traces its roots to theoretical computer science, recent algorithmic advances have drastically reduced the costs of real computations. For this reason it is important that anyone involved with computing has at least a cursory knowledge of the area. This paper surveys the field of algorithm design in two ways: first by the study of a few problems in detail, and then by a systematic view of the field. The orientation of this paper is towards the practitioner of computing (in either software or hardware); the goals of the paper are to provide both an understanding of the field and a feeling for what it can do for me. Author (GRA)

N78-32757# System Development Corp., Santa Monica, Calif.
AN AIR FORCE GUIDE TO THE COMPUTER PROGRAM DEVELOPMENT SPECIFICATION
Lloyd V. Searle Nov. 1977 104 p refs
(F19628-76-C-0236)
(AD-A055573; SDC-TM-5772/008/02; ESD-TR-78-139) Avail: NTIS HC A06/MF A01 CSCL 17/2

This report provides explanatory guidance and examples to support the effective preparation and evaluation of development specifications for computer programs. It is one of a series of guidebooks prepared to assist members of Air Force program offices in managing the software aspects of military system acquisitions. The guide contains an introductory section which outlines the manner in which requirements for computer programs should be developed during the conceptual and validation phases of a system program, including attention to implications for the nature of required technical skills of responsible Government and contractor personnel. The body of the guide is devoted to descriptions of the proper emphasis and level of content for each section and paragraph of a completed specification when prepared in accordance with the instructions contained in MIL-STD-483 for the computer program development (Part I, or Type B5) specification. Author (GRA)

N78-32758# Computer Sciences Corp., Huntsville, Ala.
HOL EVALUATION FOR MISSILE SOFTWARE APPLICATIONS Final Report
R. Palmer, J. W. Crenshaw, K. D. Dannenberg, and D. R. Griffin 8 Nov. 1977 80 p
(Contract DAAK40-77-C-0048)
(AD-A055382; CSC/TR-77/5495) Avail: NTIS HC A05/MF A01 CSCL 09/2

The authors conclude that, for significant software projects such as missile systems, use of an HOL is justified by life-cycle savings in spite of the initial one-time costs. Based upon the requirements obtained by modifying the DOD-1 IRONMAN specification, the five candidate languages were evaluated; the compilers for these languages were also evaluated. If a new compiler is developed, tailored to the needs of missile systems, J73 appears to be the better language. Compiler costs are not affected substantially by the choice of language. The existing J73 compiler offers a better base and at least as economic an approach for rehosting and retargeting as any other candidate compiler. GRA

N78-32759# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
DISTRIBUTED COMPUTATION AND TENEX-RELATED ACTIVITIES Final Report, 1 Nov. 1976 - 31 Jan. 1978
Richard E. Schantz and Robert H. Thomas May 1978 34 p
(Contract N00014-75-C-0773; ARPA Order 2935)
(AD-A055437; BBN-3809) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report describes efforts in the design of the National Software Works system and efforts to integrate TENEX into the National Software Works system. GRA

N78-32760# University of Southern Calif., Marina del Rey. Information Sciences Inst.
A SYSTEM FOR INCREMENTALLY DESIGNING AND VERIFYING PROGRAMS, VOLUME 1
Mark S. Moriconi Jan. 1978 124 p refs
(Contract DAHC15-72-C-0308; Grant NSF MCS-74-12866; ARPA Order 2223)
(AD-A055501; ISI/RR-77-65-Vol-1) Avail: NTIS HC A06/MF A01 CSCL 09/2

SID (System for Incremental Development) is a computer system for incrementally designing and verifying large, complex programs. It executes commands, proposes actions, answers questions, and accepts and reasons about new or changed information. SID has three main, distinctive characteristics: (1) it provides several useful incremental capabilities, including the ability to respond to changes by ensuring that the final problem solution is consistent and by keeping intact still-valid work without complete reprocessing; (2) its user interface has the ability to guide the user through the design and verification and to engage in an interactive English dialog about the potential effects of changes; (3) it supports a substantial programming language which includes features for generating run-time checks, stating concurrent processes and shared data, and developing data abstractions. SID has been used to completely design and verify several programs. Volume 2 (appendix) contains a transcript of a session with SID in which a simple message switching network that allows secure, asynchronous message transfer among a fixed number of users is incrementally developed. Author (GRA)

N78-32761# Massachusetts Inst. of Tech., Cambridge. Operations Research Center.
THEORY AND ALGORITHMS FOR LINEAR MULTIPLE OBJECTIVE PROGRAMS WITH ZERO-ONE VARIABLES
Gabriel R. Bitran May 1978 60 p refs
(Contract N00014-75-C-0556)
(AD-A055572; TR-150) Avail: NTIS HC A04/MF A01 CSCL 12/1

A new algorithm and theoretical results are presented for linear multiple objective programs with zero-one variables. A procedure to identify strong and weak efficient points as well as an extension of the main problem are analyzed. Extensive computational results are given and several topics for further research are discussed. Author (GRA)

N78-32762# Rensselaer Polytechnic Inst., Troy, N. Y. Computer Research Lab.
CHAP USER'S MANUAL Interim Report
Keith P. Loepere May 1978 59 p refs
(Grant AF-AFOSR-2937-76)
(AD-A055743; CRL-56; AFOSR-78-1038TR) Avail: NTIS HC A04/MF A01 CSCL 09/2

A computer representation for line drawings that has been found particularly convenient and has become widely accepted is the chain code. This representation is compact and allows most common processing functions to be performed efficiently. CHAP is a collection of FORTRAN routines designed to process chain-encoded line drawings. Routines exist in CHAP to manipulate, synthesize, analyze, and do input and output upon chains. This report is intended to serve as a user's manual for CHAP. It describes the use of the CHAP routines along with other information needed to write a program utilizing the routines. A programming example is included. Author (GRA)

N78-32763# Rensselaer Polytechnic Inst., Troy, N. Y. Computer Research Lab.
DOCUMENTATION MANUAL FOR CHAP Interim Report
Keith P. Loepere May 1978 54 p refs
(Contract AF-AFOSR-2937-76)
(AD-A055744; AFOSR-78-1039TR) Avail: NTIS HC A04/MF A01 CSCL 09/2

This is a documentation manual for the CHAP chain processing language. CHAP is a collection of routines developed for analyzing, synthesizing, and manipulating chain-encoded line drawings. This report describes the internal operation of the CHAP routines. It is a companion volume to the CHAP User's Manual. Author (GRA)

N78-32764# California Univ., Livermore. Lawrence Livermore Lab.
VECTOR PROGRAMMING TOOLS AND TECHNIQUES
Ron Litterest, Gary Long, Frank McMahon, Rich Zwakenberg, John Burk, Jerry Owens, Jeanne Martin, Richard vonHoldt, Kurt Sinz, Ned Dairiki et al 1 Dec. 1977 232 p refs
(Contract W-7405-eng-48)
(UCID-30158-Rev-1) Avail: NTIS HC A11/MF A01

A programming guide for the STAR-100 is outlined. The STAR instruction set, the implementation of that set in the LRLTRAN language, and the tradeoffs one must make to write codes that meet design goals and run fast on the STAR are described. The software available includes: system libraries, the BCON interpreter, mathematical subroutines, graphics routines, and debugging aids. Discussions of the hardware, memory, operating system, and STAR number system are given as background to illustrate good practice in planning the layout of memory and in doing input-output. ERA

N78-32765# Argonne National Lab., Ill. Applied Mathematics Div.
CHALLENGE IN NUMERICAL SOFTWARE FOR MICROCOMPUTERS
W. J. Cody 1977 24 p refs Presented At Symp. on Microcomputers: Systems, Software, Architecture, Pingree Park, Colo., 31 Aug. 1977 - 2 Sep. 1977
(Contract W-31-109-eng-38)
(CONF-770884-1) Avail: NTIS HC A02/MF A01

Microcomputers are now capable of serious numerical computation using programmed floating-point arithmetic and Basic compilers. Unless numerical software designers for these machines exploit experience gained in providing software for larger machines, history will repeat with the initial spread of treacherous software. Good software is discussed, especially for the elementary functions, in terms of reliability and robustness. The emphasis is on insight rather than detailed algorithms, to show why certain things are important and how they may be achieved. ERA

N78-32766# Ames Lab., Iowa.
USE OF SIMPLOTTER, A HIGH LEVEL PLOTTING SYSTEM
D. G. Scranton and E. G. Manchester Mar. 1978 109 p
(Contract W-7405-eng-82)
(IS-2305-Rev-4) Avail: NTIS HC A06/MF A01

The SIMPLOTTER is a high-level plotting system used for producing typical graphs quickly and easily. A typical graph might be composed of several curves, numbered axes, and a small amount of labeling. The system is designed for the needs of

the casual computer user and an environment of program experimentation and change. A set of data is graphed by specifying options when calling a problem-oriented plotting routine. Graphing options include points, lines, interpolated or smoothed curves, superposition of additional data sets, automatic or programmer-specified scaling, linear or logarithmic axes, labeling, histograms, and ideograms. Automatic scaling is based on all data sets of a graph. Plots can be generated from PL/1(F), FORTRAN (G, H, and WATFIV), and COBOL with a common plotting concept. User program logic and plotting logic can be debugged in parallel. The SIMPLOTTER is written in FORTRAN 4. ERA

N78-32767# National Technical Information Service, Springfield, Va.
COMPUTER SOFTWARE STANDARDS. A BIBLIOGRAPHY WITH ABSTRACTS Final Report, 1964 - Apr. 1978
George W. Reimherr Jun. 1978 176 p Supersedes NTIS/PS-77/7423, NTIS/PS-76/0411, and NTIS/PS-75/416
(NTIS/PS-78/0541/9; NTIS/PS-77/0423; NTIS/PS-76/0411; NTIS/PS-75/416) Avail: NTIS HC $28.00/MF $28.00 CSCL 09B

Standards for the design and development of computer software are cited. Compiler standards, programming language standards, and program development standards are included. (This updated bibliography contains 170 abstracts, 52 of which are new entries to the previous edition.) Author

N78-32768# National Technical Information Service, Springfield, Va.
COMPUTER SOFTWARE TRANSFERABILITY AND PORTABILITY. A BIBLIOGRAPHY WITH ABSTRACTS Final Report, 1970 - May 1978
George W. Reimherr Jun. 1978 79 p Supersedes NTIS/PS-77/0524 and NTIS/PS-76/0388
(NTIS/PS-78/0552/6; NTIS/PS-77/0524; NTIS/PS-76/0388) Avail: NTIS HC $28.00/MF $28.00 CSCL 09B

Problems and experience gained in transferring computer software from one computer to a different computer are discussed. Instructions on converting a software package from one environment to another are included. Advantages and disadvantages of portable software are cited. (This updated bibliography contains 73 abstracts, 22 of which are new entries to the previous edition.) S.E.S.

N78-32769# National Technical Information Service, Springfield, Va.
COMPUTER SOFTWARE RELIABILITY, VOLUME 1. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1970 - Jun. 1978
George W. Reimherr Jun. 1978 253 p
(NTIS/PS-78/0642/5) Avail: NTIS HC $28.00/MF $28.00 CSCL 09B

The research on computer software reliability modeling, software verification, and the evaluation of test tools for the measurement of software correctness is included. General discussions are included, along with the possibility of using hardware reliability models for testing software. (This updated bibliography contains 247 abstracts, none of which are new entries to the previous edition.) GRA

N78-32770# National Technical Information Service, Springfield, Va.
COMPUTER SOFTWARE RELIABILITY, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Jul. 1977 - May 1978
George W. Reimherr Jun. 1978 126 p Supersedes NTIS/PS-77/0572; NTIS/PS-76/0527; NTIS/PS-75/486
(NTIS/PS-78/0643/3; NTIS/PS-77/0572; NTIS/PS-76/0527; NTIS/PS-75/486) Avail: NTIS HC $28.00/MF $28.00 CSCL 09B

Research on computer software reliability modeling, software verification, and the evaluation of test tools for the measurement of software correctness is included. General discussions are also included, along with the possiblity of using hardware reliability models for testing software. (This updated bibliography contains 120 abstracts, all of which are new entries to the previous edition.) GRA

N78-32125# Indian Inst. of Science, Bangalore. School of Automation.
SIMULATION AND CONTROL
I. G. Sarma *In its* Space Sci., Technol. and Appl.: An Overview Apr. 1978 12 p refs (For primary document see N78-32114 23-12)
Avail: NTIS HC A10/MF A01

N78-33025# Joint Publications Research Service, Arlington, Va.
GENERAL-PURPOSE INTERPRETING SYSTEM FOR EDITING AND TRANSLATING PROGRAMS FOR STANDARD-UNIT COMPUTER HARDWARE SYSTEM (ASVT) M-600 COMPUTERS
V. N. Krekov, A. N. Tsygankov, and A. I. Udod *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 44 (JPRS-71659) 10 Aug. 1978 p 1-8 Transl. into ENGLISH from Prib. Sist. Upr. (Moscow), no. 5, 1978 p 7-9 (For primary document see N78-33024 23-99)
Copyright. Avail: NTIS HC A05/MF A01

N78-33026# Joint Publications Research Service, Arlington, Va.
PROBLEMS IN CREATION OF AN AUTOMATED DEBUGGING SYSTEM FOR THE M-7000 PROCESSOR
F. F. Buchakchiyskiy, V. F. Litvinenko, and M. A. Lobak *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 44 (JPRS-71659) 10 Aug. 1978 p 9-16 refs Transl. into ENGLISH from Prib. Sist. upr. (Moscow), no. 5, 1978 p 9-11 (For primary document see N78-33024 23-99)
Copyright. Avail: NTIS HC A05/MF A01

62 COMPUTER SYSTEMS

Includes computer networks.

No abstracts in this category.

63 CYBERNETICS

Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

N78-32771 Georgia Inst. of Tech., Atlanta.
MULTIVARIABLE CONTROL SYSTEMS, FINITE-STATE LINEAR SEQUENCIAL MACHINES, AND PROJECTIVE GEOMETRIES: SOME EXPLICIT INTERCONNECTIONS Ph.D. Thesis
Ghulam Jailani Zalmai 1978 378 p
Avail: Univ. Microfilms Order No. 7810823

Deterministic time-invariant finite-state linear sequential machines are treated as discrete-time control systems over the finite field GF(q). Adopting a modern multivariable control theory approach and a finite-geometric point of view, various structural aspects of linear machines are investigated. Numerous equivalent formulations, the relationship among state reachability, structural invariants, canonical forms, and state feedback are discussed. The concept of state observability is investigated and its relationship to state reachability is established through a duality theorem. Dissert. Abstr.

N78-32772 Arizona Univ., Tucson.
DIFFERENTIAL DYNAMIC PROGRAMMING FOR THE EFFICIENT SOLUTION OF OPTIMAL CONTROL PROBLEMS Ph.D. Thesis
Daniel Matthys Murray 1978 223 p
Avail: Univ. Microfilms Order No. 78-13591

A quadratically convergent second order differential dynamic programming method is developed for determining an optimal control in an iterative fashion. The global convergence of this method as it applies to a continuous control problem is proved.

For the discrete case the efficiency of this approach is shown in comparison to existing quadratically convergent methods. The implementability of the method is examined and its rapid convergence demonstrated. Dissert. Abstr.

N78-32773 North Carolina State Univ. at Raleigh
OPTIMAL CONTROL OF MARKOVIAN SYSTEMS WITH APPLICATIONS TO QUEUING SYSTEM Ph.D. Thesis
Charles Fred Klein, Jr. 1977 169 p
Avail: Univ. Microfilms Order No. 7811593

The problem of minimizing the cost of operating a Markovian system is studied using optimal control theory, where the ordinary differential equations describing the path of the probabilities are the system equations. The research considers fundamental issues, often ignored in previous optimal control models, such as existence of optimal controls and the applicability of the optimal control approach. In addition, new results on the form of the optimal solution are given and effective algorithms, with computational experience, are given to solve queuing control problems numerically. The research details the relationship of the optimal control approach to the Markovian dynamic programming method, the approach most often used in the queuing control literature. Dissert. Abstr.

N78-32774 California Univ., Berkeley.
BOUNDS AND COMPARISONS FOR SOME QUEUING SYSTEMS Ph.D. Thesis
Shun-Chen Niu 1977 66 p
Avail: Univ. Microfilms Order No. 7812714

Bounds and comparisons for various performance measures in tandem queueing systems and loss systems are studied. An upper bound for the expected delay in front of the second server is found for a sequence of two queues in tandem where the first server has deterministic service times, the second server has general service distribution, and the arrival process is an arbitrary renewal process. The result is extended to the case of n queues in tandem where all the servers except the last one have constant service times. Dissert. Abstr.

N78-32775 Sussex Univ., Brighton (England).
AN IMAGE INTERPRETATION SYSTEM Ph.D. Thesis
John Lawrence Paul 1977 566 p
Avail: Univ. Microfilms Order No. 78-11757

A program which interprets, in three dimensional terms, pictures of a puppet in various poses is described. Several levels and kinds of intermediate structures are used. The final interpretation of the image is basically nonquantitative, and in terms of the direction the trunk is turned, the degree of turn, the viewing angle, the angle of the limbs with respect to the trunk, etc. This interpretation is based on the 2.5 dimensional puppet, and is used to help specify the three dimensional parameters of a three dimensional puppet model which the computer can then draw. Dissert. Abstr.

N78-32776*# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
AN ANALYSIS OF THE MULTIPLE MODEL ADAPTIVE CONTROL ALGORITHM Ph.D. Thesis
Christopher Storm Greene Aug. 1978 174 p refs
(Grant NGL-22-009-124; Contract N00014-77-C-0224)
(NASA-CR-157603; ESL-TH-843) Avail: NTIS HC A08/MF A01 CSCL 09B

Qualitative and quantitative aspects of the multiple model adaptive control method are detailed. The method represents a cascade of something which resembles a maximum a posteriori probability identifier (basically a bank of Kalman filters) and a bank of linear quadratic regulators. Major qualitative properties of the MMAC method are examined and principle reasons for unacceptable behavior are explored. G.G.

N78-32777# Naval Postgraduate School, Monterey, Calif.
SINGULAR LINE THEORY AND CONTROL SYSTEMS
Constantinos Spyros A. Cariniotakis Mar. 1978 294 p refs
(AD-A055427) Avail: NTIS HC A13/MF A01 CSCL 12/1

The theory of singular lines on the Parameter Plane and in Parameter Space are derived, and applied to control system design. A method for design of compensation of linear feedback control systems using singular line theory is presented, and application of this design method for self-adaptive control systems is considered. General design steps and required procedures for using this design method are summarized and examples are presented. Author (GRA)

N78-32778# Southeastern Massachusetts Univ., North Dartmouth. Dept. of Electrical Engineering.
A REVIEW OF STATISTICAL PATTERN RECOGNITION Interim Report
C. H. Chen 19 May 1978 16 p refs
(Grant AF-AFOSR-2951-76)
(AD-A055745; EE-78-2; AFOSR-78-1040TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper examines the current status of the statistical pattern recognition by the topics: classification rules, feature extraction, contextual analysis, etc. Important but unsolved problem areas are also explored. The relationship between the statistical pattern recognition and signal processing is also considered. GRA

N78-32779# National Technical Information Service, Springfield, Va.
SPEECH RECOGNITION BY COMPUTER. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Jun. 1978
George W. Reimherr Jul. 1978 257 p Supersedes NTIS/PS-77/0631; NTIS/PS-76/0568; NTIS/PS-75/495; COM-74-11435 (NTIS/PS-78/0669/8; NTIS/PS-77/0631; NTIS/PS-76/0568; NTIS/PS-75/495; COM-74-11435) Avail: NTIS HC $28.00/MF $28.00 CSCL 17B

Investigations on the recognition, synthesis, and processing of speech by computer are presented. The research on acoustical, phonological, and linguistic processes necessary in the conversion of the various wave-forms by computers is included. (This updated bibliography contains 252 abstracts, 18 of which are new entries to the previous edition.) GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N78-32780 Tufts Univ., Medford, Mass.
THE FINITE ELEMENT METHOD FOR COUPLED HEAT AND MOMENTUM TRANSFER IN AXISYMMETRIC CYLINDRICAL COORDINATES Ph.D. Thesis
Iraj Farhi 1978 217 p
Avail: Univ. Microfilms Order No. 7816165

FORTRAN computer program was developed for finding approximate solutions to solve axisymmetric free convection problems provided their boundaries remain cylindrical. Special attention was given to vortices in general and atmospheric vortices with free convection in particular. The developed computer program was used to generate approximate solutions for several example problems in cylindrical coordinate systems. A systematic theory of FEM with regard to fluid flow problems is given. The effects of the use of Green's theorem in the theory and application of FEM were discussed. Finally, the boundary integrals are used as a guideline in the method of choosing a set of boundary conditions for different boundary value problems. Dissert. Abstr.

N78-32781 Illinois Inst. of Tech., Chicago.
CONVOLUTIONAL CODE STRUCTURE AND THE PERFORMANCE OF THE VITERBI ALGORITHM Ph.D. Thesis
Farhad Hemmati 1977 143 p
Avail: Univ. Microfilms Order No. 7811815

Reduced state Viterbi decoding of convolutional codes was studied. Necessary and sufficient conditions for the decoder to be noncatastrophic are given, upper bounds on the vent error probability and the bit error probability of the reduced state algorithm are obtained, suitable codes are constructed, and their performance is compared with maximum likelihood decoding of optimum codes with the same state complexity. Dissert. Abstr.

N78-32782*# Virginia Univ., Charlottesville. Dept. of Applied Mathematics and Computer Science.
ON THE STABILITY OF NONLINEAR DIFFERENTIAL SEQUENCES GENERATED NUMERICALLY

R. Leonard Brown 9 Oct. 1978 15 p refs Submitted for publication
(Grant NsG-1335)
(NASA-CR-157732) Avail: NTIS HC A02/MF A01 CSCL 12A

A study was conducted to determine how errors are propagated when numerical methods are applied to a differential function f(y,t) which is nonlinear in y, with emphasis on stable propagation of the errors. B.B.

N78-32783*# College of William and Mary, Williamsburg, Va. Dept. of Mathematics.
ON SEVERAL ASPECTS AND APPLICATIONS OF THE MULTIGRID METHOD FOR SOLVING PARTIAL DIFFERENTIAL EQUATIONS
Nathan Dinar Sep. 1978 58 p refs
(Contract NAS1-14972-3)
(NASA-CR-158947) Avail: NTIS HC A04/MF A01 CSCL 12A

Several aspects of multigrid methods are briefly described. The main subjects include the development of very efficient multigrid algorithms for systems of elliptic equations (Cauchy-Riemann, Stokes, Navier-Stokes), as well as the development of control and prediction tools (based on local mode Fourier analysis), used to analyze, check and improve these algorithms. Preliminary research on multigrid algorithms for time dependent parabolic equations is also described. Improvements in existing multigrid processes and algorithms for elliptic equations were studied.B.B.

N78-32784# Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.
RETARDED EQUATIONS WITH INFINITE DELAYS Interim Report
Jack K. Hale May 1978 21 p refs
(Grants AF-AFOSR-3092-76; NSF MCS-78-18858)
(AD-A055826; AFOSR-78-1103TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

It is the purpose of these notes to describe the theory of Hale and Kato for functional differential equations based on a space of initial data which satisfy some very reasonable axioms. Some recent results of Naito are also indicated showing how extensive the theory of linear systems can be developed in an abstract setting in particular, the characterization of the spectrum of the infinitesimal generator together with the decomposition theory and exponential estimates of solutions. GRA

N78-32785# Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.
SOME RECENT RESULTS ON DISSIPATIVE PROCESSES Interim Report
Jack K. Hale May 1978 15 p refs
(Grants AF-AFOSR-3092-76; DA-ARO(D)-31-124-73-G130; NSF MCS-78-18858; AF Proj. 2304)
(AD-A055908; AFOSR-78-1101TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

A detailed study of dissipative processes has obvious implications in the asymptotic behavior of solutions of differential equations. The properties of such maps have been extensively studied over the past years with the base space being a Banach space rather than R to the nth power. The results on asymptotic behavior pertain to the properties of solutions of functional differential equations of retarded and neutral type as well as certain types of partial differential equations. It is the purpose of this lecture to present some recent developments in this theory. GRA

N78-32786# Army Armament Research and Development Command, Aberdeen Proving Ground, Md. Ballistics Research Lab.
A COMPUTATIONAL ALGORITHM FOR THE EIGENVECTORS OF A SINGULAR MATRIX
Palmer R. Schlegel May 1978 17 p refs
(DA Proj. 1L1-61101-A-91A)
(AD-A055710; AD-E430041; ARBRL-TR-02059) Avail: NTIS HC A02/MF A01 CSCL 12/1

In this paper a computational, noniterative type algorithm is given to obtain the eigenvectors of a singular matrix. The algorithm yields a (smaller) nonsingular matrix that has exactly the same nonzero eigenvalues as the given singular matrix and only these eigenvalues. The eigenvectors for the singular matrix are constructed from the eigenvectors of the nonsingular matrix. The eigenvectors associated with the zero eigenvalues of the singular matrix are an immediate consequence of the algorithm. Author (GRA)

N78-32787# Massachusetts Inst. of Tech., Cambridge. Operations Research Center.
EXPERIMENTS WITH LINEAR FRACTIONAL PROBLEMS
Gabriel R. Bitran Apr. 1978 10 p refs
(Contract N00014-75-C-0556)
(AD-A055571; TR-149) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper presents the results of a limited number of experiments with linear fractional problems. Six solution procedures were tested and the results are expressed in number of simplex-like pivots required to solve a sample of twenty problems randomly generated. GRA

N78-32788# State Univ. of New York at Buffalo, Amherst. Statistical Science Div.
THE INFORMATION MATRICES OF THE PARAMETERS OF MULTIPLE MIXED TIMES SERIES
H. Joseph Newton Jun. 1977 22 p refs
(Contract N00014-75-C-0734; NR Proj. 042-234)
(AD-A056338; TR-53) Avail: NTIS HC A02/MF A01 CSCL 12/1

Closed form matrix equations are given for the information matrix of the parameters of the vector mixed autoregressive moving average time series model. Author (GRA)

N78-32789# Naval Research Lab., Washington, D. C. Radar Div.
UPDATING THE KALMAN FILTER IN TERMS OF CORRELATION COEFFICIENTS AND STANDARD DEVIATIONS Interim Report
B. H. Cantrell and G. V. Trunk 17 May 1978 10 p refs
(RR0210541)
(AD-A056359; AD-E000174; NRL-8229) Avail: NTIS HC A02/MF A01 CSCL 12/1

A factorization method of updating the Kalman filter is examined. The covariances are factored in terms of correlation coefficients and standard deviations. The covariances of the Kalman filter are then updated in terms of the factors. The technique is similar in principle to Carlson's UDU method but differs in the covariance factorization. Author (GRA)

N78-32790# Florence Univ. (Italy). Facolta d'Ingegneria.
FREDHOLM ALTERNATIVE IN THE THEORY OF BOUNDARY VALUE PROBLEMS FOR FUNCTIONAL AND DIFFERENTIAL EQUATIONS
Jozef Myjak (Cracovia Univ.) 1977 17 p refs Presented at the Seminary of the Ist. di Mat. Appl., Florence, 13 Jun. 1977
Avail: NTIS HC A02/MF A01

For linear differential equations the uniqueness of solutions of a boundary value problem implies their existence. The same is in general not true for nonlinear differential equations. Since uniqueness is usually easier to prove than existence, the question of when uniqueness will imply existence is of importance. Two approaches to this question are presented. In the first approach the linear boundary value problem is compared with another suitably chosen homogeneous problem (in general with multi-valued right hand side) and from the uniqueness of solutions for the second, conclusions on the existence of solutions for the first are drawn. In the second apprcach it is proven that for some boundary value problems for nonlinear differential equations under certain conditions, uniqueness of solutions implies their existence. ESA

N78-32150*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FPLA MECHANIZATION OF ARITHMETIC ELEMENTS TO PRODUCE A + B OR TO PASS A ONLY
D. E. Wallis, H. Taylor, and A. L. Rubin *In its* The Deep Space Network 15 Aug. 1978 p 76-80 (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 12A

N78-32153*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A FAST COMPUTATION OF COMPLEX CONVOLUTION USING A HYBRID TRANSFORM
I. S. Reed (Univ. of Southern Calif., Los Angeles) and T. K. Truong *In its* The Deep Space Network 15 Aug. 1978 p 92-99 refs (For primary document see N78-32137 23-12)
(Grant AF-AFOSR-2798-75)
Avail: NTIS HC A09/MF A01 CSCL 12A

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N78-32791 Iowa State Univ. of Science and Technology, Ames.
NONNEGATIVE REGRESSION ESTIMATION FOR SAMPLE SURVEY DATA Ph.D. Thesis
Elizabeth Ti-Jan Hsu Huang 1978 141 p
Avail: Univ. Microfilms Order No. 78-13233

Regression estimation in a sample survey when data are available from outside sources for several characteristics of the population is considered. The estimation of cell probabilities in a two-way table where the marginal probabilities are known is a special case. The generalized regression estimator and the maximum likelihood estimator are both best asymptotically normal estimators for the multinomial frequencies. A computer algorithm is designed to provide nonnegative weights for a regression type estimator. Consistent variance estimators based on the jackknife technique and on the Taylor approximation are suggested. The regression procedures are illustrated using data collected in the 1967 National Inventory of Soil and Water Conservation Needs. Dissert. Abstr.

N78-32792 Rutgers - The State Univ., New Brunswick, N. J.
ON GENERALIZING THE LAW OF THE ITERATED LOGARITHM FOR WEIGHTED SUMS OF iid RANDOM VARIABLES WITH INFINITE VARIANCE Ph.D. Thesis
Andrew James Rosalsky 1978 157 p
Avail: Univ. Microfilms Order No. 7814367

Analogues of the classical law of the iterated logarithm are considered for the weighted iid case consisting of sequences (sigma sub n Y sub n) where the weights (sigma sub n) are nonzero constants and (Y sub n) are iid random variables. Without assuming Y square integrable, necessary and, separately, sufficient conditions are given for (sigma sub n Y sub n) to obey a generalized law of the iterated logarithm in the sense that there exist positive constants a sub n for which 1im sub S sub n/a sub n = 1 with probability one where S sub n = sigma sub 1 Y sub 1 + ... + sigma sub n Y sub n. Dissert. Abstr.

N78-32793 Iowa State Univ. of Science and Technology, Ames.
TESTING FOR OUTLIERS IN LINEAR MODELS Ph.D. Thesis
Jengrong James Chen 1978 98 p
Avail: Univ. Microfilms Order No. 7813221

The problem of outlier detection in linear models is considered. When data are suspected to contain one outlier, the use of the maximum-absolute studentized residual for outlier identification is suggested. Some approximate measures of the performance of procedures based on its uses are discussed. The performance of the test depends on the position of the outlier in relation to the design matrix. When data are suspected to contain exactly two outliers, a two-outlier testing procedure is given. The performance of the test is considered, and for the special case of two-way layouts, tables of probability detection for two outliers are given. A backward deletion procedure for detecting multiple outliers is suggested. An outlier resistant regression procedure is used to identify a set of observations that is likely to contain outliers. Least squares methods are then employed to identify the specific observations to be considered outliers. Dissert. Abstr.

N78-32794 South Florida Univ., St. Petersburg.
ON THE BEHAVIOR OF GROUPINGS OF CERTAIN POPULATIONS Ph.D. Thesis
Curtis Kendell Church 1978 130 p
Avail: Univ. Microfilms Order No. 7812843

The grouping of certain populations with respect to location is considered. Means from normal populations where the means have unequal variances are studied along with the pattern of a set of k exponential populations with respect to location. A test for the homogeneity of a set of means using the criterion of the range or of the maximum gap is described. A procedure for comparing two exponential populations with respect to location is extended. The sensitivity of these methods is tested. It is shown that the maximum gap and range procedures for normal distributions are very sensitive for nonhomogeneous variances and that grouping detection for exponential distributions is very sensitive to the assumption of exponentiality. The maximum gap procedures are extended to comparisons of three exponential populations with unequal scale parameters. The distribution of the statistic is derived and tables of critical values generated for certain cases. Dissert. Abstr.

N78-32795 Stanford Univ., Calif.
VARIANCE REDUCTION TECHNIQUES FOR THE SIMULATION OF MARKOV PROCESSES Ph.D. Thesis
Philip Heidelberger 1977 135 p
Avail: Univ. Microfilms Order No. 7814178

A positive recurrent, aperiodic Markov chain is presented with state space E, transition matrix P, and stationary distribution pi. Let f be a real valued function on E and define r = pi. We examine statistically efficient methods of estimating r via simulation. The methods are designed to generate shorter confidence intervals for r than are possible with ordinary simulation techniques. It is hoped that the resulting increased accuracy of the estimates can lead to substantially shorter simulation run lengths. The techniques are based on the regenerative method of simulation, which observes that when simulating certain types of stochastic processes (including positive recurrent Markov chains), the run can be broken up into random spaced independent and identically distributed blocks. The classical statistical techniques of estimation can then be used to analyze the output of the simulation. Dissert. Abstr.

N78-32796 Ohio Univ., Athens.
A CONSTRAINED MARKOV POPULATION MODEL Ph.D. Thesis
Louis Edgar Sahr 1978 179 p
Avail: Univ. Microfilms Order No. 7812382

The major problem in scheduling future hospital admissions is anticipating the number of beds that will be available when patients arrive for admission. The problem was formulated as a nonlinear programming problem to find the number of electives to scheduling for admission on each day in a scheduling period. The hospital census distributions are based on a Markov population model defined on patient states of health and describes the number of patients in each state. An heuristic scheduling algorithm based on multivariate normal approximations to census distributions was employed to generate schedules for electric admission over a future scheduling period. Computer programs were developed for scheduling and for simulation of the scheduling algorithms. Dissert. Abstr.

N78-32797 Michigan Univ., Ann Arbor.
STOCHASTIC MODELS OF TECHNOLOGY DIFFUSION Ph.D. Thesis
Stephen Michael Horner 1977 98 p
Avail: Univ. Microfilms Order No. 78-04726

Simple stochastic models of epidemics have often been employed by economists and sociologists in the study of the diffusion of information or new technology. The properties of a family of models related to these epidemic processes are investigated and how the results can be used in the study of technical change phenomena is demonstrated. A moving limit is hypothesized to the level of productivity of capital; the exact increment is determined exogeneously by basic or applied research carried on outside the industry. It is the level of latent productivity (LPRO) which fills the role of the disease which spreads through the industry. In the single advance models, LPRO is assumed to have moved forward at some point in time, after which an individual firm may advance to the limit by virtue of its own research and development or through imitation of the successful efforts of another firm. The discrete time models are studied

using the tools of probability theory with occasional supplementation with deterministic differential equation analogs.
Dissert. Abstr.

N78-32798*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ANALYSIS OF DYNAMIC SYSTEM RESPONSE TO PRODUCT RANDOM PROCESSES
Kenneth Sidwell (Joint Instr. for Advancement of Flight Sciences) Sep. 1978 47 p refs
(NASA-TM-78667; L-12047) Avail: NTIS HC A03/MF A01 CSCL 12A

The response of dynamic systems to the product of two independent Gaussian random processes is developed by use of the Fokker-Planck and associated moment equations. The development is applied to the amplitude modulated process which is used to model atmospheric turbulence in aeronautical applications. The exact solution for the system response is compared with the solution obtained by the quasi-steady approximation which omits the dynamic properties of the random amplitude modulation. The quasi-steady approximation is valid as a limiting case of the exact solution for the dynamic response of linear systems to amplitude modulated processes. In the nonlimiting case the quasi-steady approximation can be invalid for dynamic systems with low damping. Author

N78-32799# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
A PROBLEM IN MULTIVARIATE STATISTICS: ALGORITHM, DATA STRUCTURE AND APPLICATIONS Interim Report
Jon Louis Bentley and Michael Ian Shamos Apr. 1978 13 p refs
(Contract N00014-76-C-0370)
(AD-A055818; CMU-CS-78-110) Avail: NTIS HC A02/MF A01 CSCL 12/1

Problems and applications are investigated which are associated with computing the empirical cumulative distribution function of N points in k-dimensional space and a multidimensional divide-and-conquer technique is employed that gives rise to a compact data structure for geometric and statistical search problems. A large number of important statistical quantities are computed much faster than was previously possible. GRA

N78-32800# Delaware Univ., Newark. Dept. of Statistics and Computer Science.
NUMERICAL METHODS FOR A CLASS OF MARKOV CHAINS ARISING IN QUEUEING THEORY Interim Report
David Michael Lucantoni and Marcel F. Neuts May 1978 103 p refs
(Grant AF-AFOSR-3236-77)
(AD-A055946; TR-78/10; AFOSR-78-1049TR) Avail: NTIS HC A06/MF A01 CSCL 12/1

An algorithm is discussed for computing the stationary probability vector of an infinite-state Markov chain whose transition probability matrix has a block-partitioned structure. Such matrices arise in a wide variety of queueing models as well as generalized random walk problems. Traditionally, the analytic approach to this type of problem has been through complex variable methods. An alternate and unified treatment of this problem is presented and an algorithm is obtained which utilizes only real arithmetic computations. In addition, most of the intermediate steps of the algorithm have useful probabilistic interpretations. GRA

N78-32801# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
CHI-SQUARE TECHNIQUES Interim Report
David S. Moore May 1978 39 p refs
(Grant AF-AFOSR-3291-77)
(AD-A055435; AFOSR-78-1048TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper is a chapter appearing in a handbook on goodness of fit for users of statistics. Both the classical chi-square test and modern variations are discussed. Recommendations are made on the overall usefulness of these tests as well as on specific issues such as choice of cells. Numerical examples are included, using data sets which will appear in the book. Author (GRA)

N78-32802# Pennsylvania State Univ., University Park. Coll. of Business Administration.
CHOICE PROBABILITIES AND CHOICE FUNCTIONS Interim Report
Peter C. Fishburn Jun. 1978 30 p refs
(Contract N00014-75-C-0857)
(AD-A055838; TR-28) Avail: NTIS HC A03/MF A01 CSCL 12/1

Although there are sizable literatures on the connections between choice probabilities and preference relations, and between preference relations and choice functions, little has been done, apart from their common ties to preference relations, to connect choice probabilities and choice functions. The latter connection is studied in this report. A family of choice functions that depends on a threshold parameter is defined from a choice probability function. It is then shown what must be true of the choice probability function so that the choice functions satisfy three traditional rationality conditions. Conversely, it is shown what must be true of the choice functions so that the choice probability function satisfies a version of Luce's axiom for individual choice probabilities. Author (GRA)

N78-32803# State Univ. of New York at Buffalo, Amherst. Statistical Science Div.
CONSISTENCY OF THE AUTOREGRESSIVE METHOD OF DENSITY ESTIMATION
Jean-Pierre Carmichael Mar. 1978 26 p refs
(Contract N00014-75-C-0734; NR Proj. 042-234)
(AD-A056337; TR-61) Avail: NTIS HC A03/MF A01 CSCL 12/1

A density function f(dot), with 1/f (dot) both Lebesgue-integrable, has a representation as an autoregressive spectral density. This representation is used to obtain new density autoregressive estimators of different orders p based on the empirical characteristic function of a sample of size n. The consistency of these new estimators is shown under varying conditions on the smoothness of f(dot). GRA

N78-32147*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
USE OF A PRIORI STATISTICS TO MINIMIZE ACQUISITION TIME FOR RFI IMMUNE SPREAD SPECTRUM SYSTEMS
J. K. Holmes and K. T. Woo *In its* The Deep Space Network 15 Aug. 1978 p 62-69 refs (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 12A

N78-32151*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A PROBABILISTIC SPERNER'S THEOREM, WITH APPLICATIONS TO THE PROBLEM OF RETRIEVING INFORMATION FROM A DATA BASE
L. D. Baumert, R. J. McEliece, E. R. Rodemich, and H. Rumsey, Jr. *In its* The Deep Space Network 15 Aug. 1978 p 81-86 refs (For primary document see N78-32137 23-12)
Avail: NTIS HC A09/MF A01 CSCL 12A

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N78-32804 Rice Univ., Houston, Tex.
CHEBYSHEV MINIMAX PROBLEMS AND NUMERICAL OPTIMIZATION Ph.D. Thesis
Bhabani Prasad Mohanty 1978 94 p
Avail: Univ. Microfilms Order No. 7814783

A transformation technique was developed to handle a class of optimal control problems with a Chebyshev minimax performance index within the framework of the classical Mayer problem wherein the performance index becomes an additional parameter of the problem. The transformation also introduces an inequality constraint, which is akin to a state variable inequality constraint. Two different categories of numerical optimization schemes were explored. The first one is an indirect method, that is a continuous version of the sequential gradient-restoration algorithm. The second category belongs to direct methods of multiple subarc types. A two-subarc class of algorithms was developed to handle

minimax programs known to have a unique minimax point. The solution of minimax problems having a flat minimax was examined via a three-subarc approach where the middle subarc becomes the flat minimax solution the problem. Dissert. Abstr.

N78-32805# Nagoya Univ. (Japan). Inst. of Plasma Physics.
RANDOMLY TRANSITIONAL PHENOMENA IN THE SYSTEM GOVERNED BY DUFFING'S EQUATION
Yoshisuke Ueda Jun. 1978 22 p refs
(IPPJ-341) Avail: NTIS HC A02/MF A01

Turbulent or chaotic phenomena which occur in the system governed by Duffing's equation are examined, a special type of 2-dimensional periodic systems. By using analog and digital computers, experiments were undertaken with special reference to the changes of attractors and of average power spectra of the random processes under the variation of the system parameters. On the basis of the experimental results, an outline of the random process is made clear. The results obtained in this paper are applied to the phenomena of the same kind which occur in 3-dimensional autonomous systems. G.Y.

N78-32806# Naval Postgraduate School, Monterey, Calif.
THE DYNAMIC PROGRAMMING APPROACH TO THE MULTICRITERION OPTIMIZATION PROBLEM M.S. Thesis
Kim Kwang Bog Mar. 1978 64 p refs
(AD-A055697) Avail: NTIS HC A04/MF A01 CSCL 12/2

Decision makers are often confronted with problems for which there exist several distinct measures of success. Such problems can often be expressed in terms of linear or nonlinear programming models with several 'criterion' functions instead of single objective functions. A variety of techniques have been applied to multicriterion problems, but the approach used here, 'The Dynamic Programming Approach to Multicriterion Optimization Problem,' is based on the concept that the ideal solution to a multiobjective problem must be a pareto optimal solution. In many cases simply narrowing the set of candidate solutions to the set of all pareto optimal solutions may enable the decision maker to find the compromise being sought. The determination of nondominated points and corresponding nondominated values (pareto optimal solution) related to the multicriterion optimization problem is approached through the use of dynamic programming. The dynamic programming approach has an attractive property which provides the basis for generation of nondominated solutions at each stage by the decomposition method. By using recursive equations we can find out the nondominated points and corresponding nondominated solutions of multiaggregate return function. Author (GRA)

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N78-32807# Texas Technological Univ., Lubbock. Dept. of Electrical Engineering.
RESOLUTION SPACE, NETWORKS AND NON-SELF-ADJOINT SPECTRAL THEORY Interim Scientific Report, 1 Apr. 1977 - 31 Mar. 1978
R. Saeks 31 Mar. 1978 12 p refs
(Grant AF-AFOSR-2631-74)
(AD-A055434; AFOSR-78-0899TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Specific attention is given to the solution of a Wiener-Hopf-like 'Basic Stochastic Optimization Problem', the solution of the feedback system stability problem for nonlinear and time-varying systems, and the formulation of a theory of systems defined in a Banach resolution space. GRA

N78-32808# Oak Ridge National Lab., Tenn.
ANALYTIC ANGULAR INTEGRATION TECHNIQUE FOR GENERATING MULTIGROUP TRANSFER MATRICES
J. A. Bucholz 1978 11 p refs Presented at a Workshop on Multigroup Nucl. Cross-section Preparation, Oak Ridge, Tenn., 14 Mar. 1978
(Contract W-7405-eng-26)
(CONF-780329-1) Avail: NTIS HC A02/MF A01

An alternative technique for generating data from the total scattering cross section of a particular nuclide on a pointwise energy basis, sigma, and some information regarding the angular scattering distribution for each initial energy point is outlined. The evaluation of generalized multigroup transfer matrices for transport calculations requires a double integration extending over the primary and secondary energy groups, where, for a given initial energy, the integration over the secondary energy group may be replaced by an integral over the possible scattering angles. Analytic expressions for these angular integrals are derived which are free of truncation error. Differences between the present method and other methods are explored. Of particular interest is that, for hydrogen, the angular integration is shown to simplify to the point that, for many weight functions, the integration over the primary energy group might also be performed analytically. ERA

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N78-32809*# Suntech, Inc., Marcus Hook, Pa.
STUDY OF DYNAMIC EMISSION SPECTRA FROM LUBRICANT FILMS IN AN ELASTOHYDRODYNAMIC CONTACT USING FOURIER TRANSFORM SPECTROSCOPY Final Report, 1 Jan. 1976 - 31 Dec. 1977
J. L. Lauer (Rensselaer Polytechnic Inst., Troy, N. Y.) 28 Aug. 1978 128 p refs
(Contract NAS3-19758)
(NASA-CR-159418) Avail: NTIS HC A07/MF A01 CSCL 20K

Infrared emission spectra were obtained through a diamond window from lubricating fluids in an operating sliding elastohydrodynamic contact and analyzed by comparison with static absorption spectra under similar pressures. Different loads, shear rates and temperatures were used. Most of the spectra exhibited polarization characteristics, indicating directional alignment of the lubricant in the EHD contact. Among the fluids studied were a 'traction' fluid, an advanced ester, and their mixtures, a synthetic paraffin, a naphthenic reference fluid (N-1), both neat and containing 1 percent of p-tricresyl phosphate as an anti-wear additive, and a C-ether. Traction properties were found to be nearly proportional to mixture composition for traction fluid and ester mixtures. The anti-wear additive reduced traction and fluid temperature under low loads but increased them under higher loads, giving rise to formation of a friction polymer. GRA

N78-32810# California Univ., Livermore. Lawrence Livermore Lab.
EFFI: A CODE FOR CALCULATING THE ELECTROMAGNETIC FIELD, FORCE, AND INDUCTANCE IN COIL SYSTEMS OF ARBITRARY GEOMETRY
S. J. Sackett 29 Mar. 1978 19 p refs
(Contract W-7405-eng-48)
(UCRL-52402) Avail: NTIS HC A02/MF A01

The EFFI code calculates the electromagnetic field and vector potential in coil systems of arbitrary geometry. The coils are made from circular arc and/or straight segments of rectangular cross-section conductor. EFFI can also calculate magnetic flux lines, magnetic force, and inductance. The methods used for the calculations are based on a combination of analytical and numerical integration of the Biot-Savart law for a volume distribution of current. These methods yield accurate field values inside and outside the conductor. All input to EFFI is format-free and is checked for validity before any calculations are done. Any errors detected during the check produce a diagnostic that lists the error, the code's objection to it, and the number of the offending data card. EFFI produces output in both printed and graphical form. Each page of output is labeled with the title of the problem, the time, the computer and date of the run, and the version number and compilation date for EFFI. ERA

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N78-32811 Rhode Island Univ., Kingston.
A GENERAL THEORY OF ACOUSTIC PROPAGATION WITH APPLICATIONS TO STRONG ACOUSTIC SCATTERING IN THE ATMOSPHERE AND OCEAN Ph.D. Thesis
Joseph Raymond Breton 1978 397 p
Avail: Univ. Microfilms Order No. 7813259

An exact solution to adiabatic acoustic propagation in arbitrary media is detailed that was obtained by a new algorithm derived from the field feed-back theorem (FF-BT). The theory leading to the general solution permits cataloging the models of the literature based on their assumptions and determines quantitatively the circumstances under which they are valid. Solutions for scattering from interfaces (and particularly the ocean surface) are obtained which agree with and extend the classical solutions. Dissert. Abstr.

N78-32812 Stanford Univ., Calif.
A CCD PHASED-ARRAY ULTRASONIC IMAGING SYSTEM Ph.D. Thesis
James Terrell Walker 1978 200 p
Avail: Univ. Microfilms Order No. 78-14217

An electronically scanned phased array ultrasonic imaging system with 25 active channels and utilizing continuous variations of charge coupled device (CCD) delay with clock frequency to produce dynamic focusing was designed, developed, and tested. The multiplicative algorithm, optimized for single input/single output CCD's obtains real time scan generation and control. The phased array contains 31 piezoelectric transducers and a separate transmitter and receiver for each element. A CCD in each receiver synthesizes electronically the equivalent of a lens focused on the desired object point. Additional circuitry sums the element outputs, control array scanning, and generates the display. The system provides the synthesis of an ultrasonic beam pattern sweeping over a 60 deg planar sector in the body and an oscilloscope display of the received ultrasonic echoes from a cross section of the human organ. Dissert. Abstr.

N78-32813# Aeronautical Research Labs., Melbourne (Australia).
CRACK DEPTH MEASUREMENT BY ULTRASONICS
P. A. Doyle and C. M. Scala Dec. 1977 19 p refs
(ARL-Mat-Rept-107; AR-000-1107) Copyright. Avail: Issuing Activity

Bulk and surface wave ultrasonic methods are given for measuring the depth of surface-breaking cracks. Research is considered which relates to techniques for measuring crack depth by studying the scattered pulse amplitude, by using time-of-flight methods, or by carrying out ultrasonic spectroscopic analysis. Measurement of the transit time of bulk waves appears most likely to provide simple and reliable depth measurement in the near future, although further work in the other two areas should lead to the development of valuable techniques. Some suggestions are made of promising directions for future research. A.R.H.

N78-32814*# National Aeronautics and Space Administration, Washington, D. C.
RECENT ADVANCES CONCERNING AN UNDERSTANDING OF SOUND TRANSMISSION THROUGH ENGINE NOZZLES AND JETS
D. Bechert, U. Michel, and E. Dfizenmaier Sep. 1978 27 p refs Transl. into ENGLISH of the Conf. paper from the Deutsche Gesellschaft fuer Luft- und Raumfahrt, Paper-77-48, West Ger. 24 p Presented at the 10th Jahrestagung, Berlin, 13-15 Sep. 1977 Original language document was announced as A78-24437 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75454; Paper-77-48) Avail: NTIS HC A03/MF A01 CSCL 20A

Experiments on the interaction between a turbulent jet and pure tone sound coming from inside the jet nozzle are reported. This is a model representing the sound transmission from sound sources in jet engines through the nozzle and the jet flow into the far field. It is shown that pure tone sound at low frequencies is considerably attenuated by the jet flow, whereas it is conserved at higher frequencies. On the other hand, broadband jet noise can be amplified considerably by a pure tone excitation. Both effects seem not to be interdependent. Knowledge on how they are created and on relevant parameter dependences allow new considerations for the development of sound attenuators. Author

N78-32815*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
LABORATORY AND COMMUNITY STUDIES OF AIRCRAFT NOISE EFFECTS
David G. Stephens and Clemans A. Powell Sep. 1978 16 p refs Presented at the Intern. Congr. on Noise as a Public Health Probl. - Biol. and Behavioral Effects, Freiburg, West Ger., 25-29 Sep. 1978
(NASA-TM-78776) Avail: NTIS HC A02/MF A01 CSCL 20A

The noise effects programs objective is to develop aircraft noise criteria and noise reduction methods for achieving greater community and passenger acceptance of air transportation systems. The approach consists of laboratory tests to subjectively evaluate the properties of aircraft-generated noise that are responsible for causing annoyance and field surveys to study the broader problems of community and passenger acceptability. The program is organized into two major thrusts: community acceptance and passenger acceptance. The community acceptance includes subjective response studies of single and multiple aircraft overflights as well as longer term community noise exposure. Emphasis is on the development of units and indices which accurately quantify annoyance. The passenger acceptance program includes studies to determine acceptably levels of interior noise and vibration for speech intelligibility and comfort of crew and passengers. Selected results from several recent studies are presented to indicate the nature, scope, and methods of the research program. L.S.

N78-32816*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
HELICOPTER ACOUSTICS
Aug. 1978 399 p refs Presented at the Intern. Specialists Symp., Hampton, Va., 22-24 May 1978; sponsored by the Am. Helicopter Soc. and AROD
(NASA-CP-2052-Pt-1; L-12339) Avail: NTIS HC A17/MF A01 CSCL 20A

Exterior and interior noise problems are addressed both from the physics and engineering as well as the human factors point of view. The role of technology in closing the gap between what the customers and regulating agencies would like to have and what is available is explored. Noise regulation concepts, design, operations and testing for noise control, helicopter noise prediction, and research tools and measurements are among the topics covered. For individual titles, see N78-32817 through N78-32835.

N78-32817*# Federal Aviation Administration, Washington, D. C.
HELICOPTER EXTERNAL NOISE REQUIREMENTS: FAA PERSPECTIVE
Charles R. Foster *In* NASA. Langley Res. Center Helicopter Acoustics Aug. 1978 p 1-16 (For primary document see N78-32816 23-71)
Avail: NTIS HC A17/MF A01 CSCL 20A

Enactment of helicopter noise certification standards for the control of noise impact contributing to community annoyance is considered in terms of the development of helicopters as an environmentally compatible air transportation mode. Increased use of helicopters for commercial applications and public awareness of aircraft noise are cited as factors making development of helicopter noise standards necessary both for the protection of the environmental interest of the community and to ensure the orderly growth of the helicopter industry itself. Noise sources, technology trends in helicopter design, and design concepts to control helicopter noise are discussed along with the regulatory background and specific helicopter regulatory concepts. J.M.S.

N78-32818*# Helicopter Association of America, Washington, D. C.

HELICOPTER NOISE REGULATIONS: AN INDUSTRY PERSPECTIVE

R. A. Wagner *In* NASA. Langley Res. Center Helicopter Acoustics Aug. 1978 p 17-32 refs (For primary document see N78-32816 23-71)

Avail: NTIS HC A17/MF A01 CSCL 20A

A review of helicopter noise measurement programs and noise reduction/economic studies of FAA is given along with a critique of a study which addresses the economic impact of noise reduction on helicopter noise. Modification of several helicopters to reduce noise and demonstrate the economic impact of the application of the current state-of-the-art technology is discussed. Specific helicopters described include Boeing Vertol 347 Helicopter, Hughes OH-6 Helicopter, and Hughes 269C Helicopter. Other topics covered include: (1) noise trends and possible noise limits; (2) accuracy of helicopter noise prediction techniques; (3) limited change possibilities of derivatives; and (4) rotor impulsive noise. The unique operational capabilities of helicopters and the implications relative to noise regulations and certification are discussed. J.M.S.

N78-32819*# Army Aviation Research and Development Command, St. Louis, Mo.

NOISE REQUIREMENTS FROM A MILITARY POINT OF VIEW

Charles C. Crawford, Jr. *In* NASA. Langley Res. Center Helicopter Acoustics Aug. 1978 p 33-44 refs (For primary document see N78-32816 23-71)

Avail: NTIS HC A17/MF A01 CSCL 20A

External and internal aircraft noise requirements are discussed in terms of application to military helicopters. The impact of the application of noise reduction technology to comply with FAA standards on cost and performance is emphasized. J.M.S.

N78-32820*# Hughes Helicopters, Culver City, Calif.

THE IMPACT OF URBAN OPERATIONS ON HELICOPTER NOISE REQUIREMENTS

Stanley R. Spector *In* NASA. Langley Res. Center Helicopter Acoustics Aug. 1978 p 45-59 refs (For primary document see N78-32816 23-71)

Avail: NTIS HC A17/MF A01 CSCL 20A

The interrelationship of urban helicopter operations, helicopter noise, and the establishment of urban public-use heliports is discussed. Public resistance to urban helicopter operations due to concern for safety and noise is shown to negatively impact the establishment of public-use heliports in urban centers. It is indicated that increased government and industry effort to reduce helicopter noise is needed to ensure continued growth in the helicopter industry. J.M.S.

N78-32821*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.

PREDICTION AND REDUCTION OF ROTOR BROADBAND NOISE

Richard E. Hayden and Krishna S. Aravamudan *In* NASA. Langley Res. Center Helicopter Acoustics Aug. 1978 p 61-87 refs (For primary document see N78-32816 23-71)

Avail: NTIS HC A17/MF A01 CSCL 20A

Prediction techniques which can be or have been applied to subsonic rotors, and methods for designing helicopter rotors for reduced broadband noise generation are summarized. It is shown how detailed physical models of the noise source can be used to identify approaches to noise control. J.M.S.

N78-32822*# Westland Helicopters Ltd., Hayes (England).

THEORETICAL MODELS OF HELICOPTER ROTOR NOISE

D. L. Hawkings *In* NASA. Langley Res. Center Helicopter Acoustics Aug. 1978 p 89-108 refs (For primary document see N78-32816 23-71)

Avail: NTIS HC A17/MF A01 CSCL 20A

For low speed rotors, it is shown that unsteady load models are only partially successful in predicting experimental levels. A theoretical model is presented which leads to the concept of unsteady thickness noise. This gives better agreement with test results. For high speed rotors, it is argued that present models are incomplete and that other mechanisms are at work. Some possibilities are briefly discussed. J.M.S.

N78-32823*# United Technologies Research Center, East Hartford, Conn.

NOISE DUE TO ROTOR-TURBULENCE INTERACTION

R. K. Amiet *In* NASA. Langley Res. Center Helicopter Acoustics Aug. 1978 p 109-126 refs (For primary document see N78-32816 23-71)

Avail: NTIS HC A17/MF A01 CSCL 20A

A procedure for calculating the noise due to turbulent inflow to a propeller or helicopter rotor in hover is summarized. The method is based on a calculation of noise produced by an airfoil moving in rectilinear motion through turbulence. At high frequency the predicted spectrum is broadband, while at low frequency the spectrum is peaked around multiples of blade passage frequency. The results of a parametric study of the variation of the noise with rotor tip speed, blade number, chord, turbulence scale, and directivity angle are given. A comparison of the theory with preliminary experimental measurements shows good agreement. J.M.S.

N78-32824*# Stanford Univ., Calif.

THEORY ON ACOUSTIC SOURCES

S. E. Wright *In* NASA. Langley Res. Center Helicopter Acoustics Aug. 1978 p 127-147 refs Sponsored by ONERA (For primary document see N78-32816 23-71)

Avail: NTIS HC A17/MF A01 CSCL 20A

A theory is described for the radiation emission emission from acoustic multipole sources. The sources can be stationary or moving at speeds including supersonic and experience stationary or moving disturbances. The effect of finite source disturbutions and disturbances is investigated as well as the manner in which they interact. Distinction is made between source distributions that responsed as a function of time and those that respond as a function of space. J.M.S.

N78-32825*# Naval Ship Research and Development Center, Bethesda, Md.

POTENTIAL ACOUSTIC BENEFITS OF CIRCULATION CONTROL ROTORS

Robert M. Williams and Ian C. Cheeseman (Southampton Univ.) *In* NASA. Langley Res. Center Helicopter Acoustics Aug. 1978 p 149-179 refs (For primary document see N78-32816 23-71)

Avail: NTIS HC A17/MF A01 CSCL 20A

The fundamental aeroacoustic mechanisms responsible for noise generation on a rotating blade are theoretically examined. Their contribution to the overall rotor sound pressure level is predicted. Results from a theory for airfoil trailing edge noise are presented. Modifications and extensions to other source theories are described where it is necessary to account for unique aspects of circulation control (CC) aerodynamics. The circulation control rotor (CCR), as embodied on an X-wing vertical takeoff and landing (VTOL) aircraft, is used as an example for computational purposes, although many of the theoretical results presented are generally applicable to other CC applications (such as low speed rotors, propellers, compressors, and fixed wing aircraft). Using the analytical models, it is shown that the utilization CC aerodynamics theoretically makes possible unprecedented advances in rotor noise reduction. For the X-wing VTOL these reductions appear to be feasible without incurring significant attendant performance and weight penalties. J.M.S.

N78-32826*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

HELICOPTER NOISE RESEARCH AT THE LANGLEY V/STOL TUNNEL

Danny R. Hoad (AVRADCOM Res. and Technol. Labs.) and George C. Green *In its* Helicopter Acoustics Aug. 1978 p 181-204 refs (For primary document see N78-32816 23-71)

Avail: NTIS HC A17/MF A01 CSCL 20A

The noise generated from a 1/4-scale AH-1G helicopter configuration was investigated in the Langley V/STOL tunnel. Microphones were installed in positions scaled to those for which flight test data were available. Model and tunnel conditions were carefully set to properly scaled flight conditions. Data presented indicate a high degree of similarity between model and flight test results. It was found that the pressure time history waveforms are very much alike in shape and amplitude. Blade slap when it occurred seemed to be generated in about the same location in the rotor disk as on the flight vehicle. If model and tunnel

conditions were properly matched, including inflow turbulence characteristics, the intensity of the blade-slap impulse seemed to correlate well with flight. J.M.S.

N78-32827*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EXPLORATORY WIND-TUNNEL INVESTIGATION OF THE EFFECT OF THE MAIN ROTOR WAKE ON TAIL ROTOR NOISE
Robert J. Pegg and Phillip A. Shidler *In its* Helicopter Acoustics Aug. 1978 p 205-219 refs (For primary document see N78-32816 23-71)
Avail: NTIS HC A17/MF A01 CSCL 20A

Approaches to minimizing the noise generated by the interaction of the tail rotor blades with the wake of the main rotor considered include repositioning of the tail rotor with respect to the main rotor, changes in the rotational direction of the tail rotor, and modification of the main rotor tip vortex. A variable geometry model was built which had the capability of varying tail rotor position relative to the main rotor as well as direction of tail rotor rotation. Acoustic data taken from the model in the Langley anechoic noise facility indicates interaction effects due to both main rotor shed vortex and the main rotor turbulence. J.M.S.

N78-32828*# Massachusetts Inst. of Tech., Cambridge.
WIND TUNNEL INVESTIGATIONS OF MODEL ROTOR NOISE AT LOW TIP SPEEDS
K. S. Aravamudan, A. Lee, and W. L. Harris *In* NASA. Langley Res. Center Helicopter Acoustics Aug. 1978 p 221-261 refs (For primary document see N78-32816 23-71)
(Contract DAAG29-76-C-0027)
Avail: NTIS HC A17/MF A01 CSCL 20A

Experimental and related analytical results on model rotor rotational and broadband noise obtained in the anechoic wind tunnel and rotor facility are summarized. Factors studied include various noise sources, effects of helicopter performance parameters on noise generated by a model main rotor, appropriate scaling laws for the various types of main rotor noise, and the effects of intensity and size scales of injected turbulence on the intensity and spectra of broadband noise. J.M.S.

N78-32829*# Textron Bell Helicopter, Ft. Worth, Tex.
HELICOPTER EXTERNAL NOISE PREDICTION AND CORRELATION WITH FLIGHT TEST
Bharat P. Gupta *In* NASA. Langley Res. Center Helicopter Acoustics Aug. 1978 p 263-275 refs (For primary document see N78-32816 23-71)
Avail: NTIS HC A17/MF A01 CSCL 20A

Mathematical analysis procedures for predicting the main and tail rotor rotational and broadband noise are presented. The aerodynamic and acoustical data from Operational Loads Survey (OLS) flight program are used for validating the analysis and noise prediction methodology. For the long method of rotational noise prediction, the spanwise, chordwise, and azimuthwise airloading is used. In the short method, the airloads are assumed to be concentrated at a single spanwise station and for higher harmonics an airloading harmonic exponent of 2.0 is assumed. For the same flight condition, the predictions from long and short methods of rotational noise prediction are compared with the flight test results. The short method correlates as well or better than the long method. J.M.S.

N78-32830*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FULL-SCALE TESTING OF AN OGEE TIP ROTOR
Wayne R. Mantay (AVRADCOM Res. and Technol. Labs.), Richard L. Campbell, and Phillip A. Shidler *In its* Helicopter Acoustics Aug. 1978 p 277-308 refs (For primary document see N78-32816 23-71)
Avail: NTIS HC A17/MF A01 CSCL 20A

Full scale tests were utilized to investigate the effect of the ogee tip on helicopter rotor acoustics, performance, and loads. Two facilities were used: the Langley whirl tower and a UH-1H helicopter. The text matrix for hover on the whirl tower involved thrust values from 0 to 44 480 N (10,000 lb) at several tip Mach numbers for both standard and Ogee rotors. The full scale testing on the UH-1H encompassed the major portion of the flight envelope for that aircraft. Both near field acoustic measurements and far field flyover data were obtained for both the ogee and standard rotors. Data analysis of the whirl tower test shows that the ogee tip does significantly diffuse the tip vortex while providing some improvement in hover performance at low and moderate thrust coefficients. Flight testing of both rotors indicates that the strong impulsive noise signature of the standard rotor can be reduced with the ogee rotor. Analysis of the spectra indicates a reduction in energy in the 250 Hz and 1000 Hz range for the ogee rotor. Forward flight performance was significantly improved with the ogee configuration for a large number of flight conditions. Further, rotor control loads were reduced through use of this advanced tip rotor. J.M.S.

N78-32831*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HOVERING IMPULSIVE NOISE: SOME MEASURED AND CALCULATED RESULTS
D. A. Boxwell (AVRADCOM Res. and Technol. Labs.), Y. H. Yu (AVRADCOM Res. and Technol. Labs.), and F. H. Schmitz (AVRADCOM Res. and Technol. Labs.) *In* NASA. Langley Res. Center Helicopter Acoustics Aug. 1978 p 309-322 refs (For primary document see N78-32816 23-71)
Avail: NTIS HC A17/MF A01 CSCL 20A

In-plane impulsive noise radiating from a hovering model rotor was measured in an anechoic environment. The hover acoustic signature was compared with existing theoretical prediction models with previous forward flight experiments using the same model rotor. These hover tests showed good experimental consistency with forward flight measurements, both in pressure level, and waveform character, over the range of Mach numbers tested (0.8 to 1.0). Generally poor correlation, however, was confirmed with current linear theory prediction efforts. Failure to predict both the peak pressure levels and the shape was reported, especially with increasing tip Mach number. J.M.S.

N78-32832*# Tokyo Univ. (Japan).
IMPROVED METHODS FOR CALCULATING THE THICKNESS NOISE
Yoshiya Nakamura and Akira Azuma *In* NASA. Langley Res. Center Helicopter Acoustics Aug. 1978 p 323-337 refs (For primary document see N78-32816 23-71)
Avail: NTIS HC A17/MF A01 CSCL 20A

Advanced methods to compute the rotor thickness noise which is predominant in the case of high speed rotor were developed. These methods were deduced from a previous method by transforming the integral coordinate, commuting the order of integration and differential, and/or performing chordwise integration analytically with some adequate assumption. The necessary computational times and waveforms obtained by the previous and three advanced methods were compared. It was then concluded that the advanced methods could save the computational time compared with the previous method with the same accuracy. J.M.S.

N78-32833*# Hamilton Standard, Windsor Locks, Conn.
THE IMPORTANCE OF QUADRUPOLE SOURCES IN PREDICTION OF TRANSONIC TIP SPEED PROPELLER NOISE
Donald B. Hanson and Martin R. Fink (United Technol. Res. Center) *In* NASA. Langley Res. Center Helicopter Acoustics Aug. 1978 p 339-371 refs Presented at the Spring Meeting of the Inst. of Acoustics, Cambridge, England, 7 Apr. 1978 Submitted for publication (For primary document see N78-32816 23-71)
Avail: NTIS HC A17/MF A01 CSCL 20A

A theoretical analysis is presented for the harmonic noise of high speed, open rotors. Far field acoustic radiation equations based on the Ffowcs-Williams/Hawkings theory are derived for a static rotor with thin blades and zero lift. Near the plane of rotation, the dominant sources are the volume displacement and the rho U(2) quadrupole, where u is the disturbance velocity component in the direction blade motion. These sources are compared in both the time domain and the frequency domain using two dimensional airfoil theories valid in the subsonic, transonic, and supersonic speed ranges. For nonlifting parabolic arc blades, the two sources are equally important at speeds between the section critical Mach number and a Mach number

of one. However, for moderately subsonic or fully supersonic flow over thin blade sections, the quadrupole term is negligible. It is concluded for thin blades that significant quadrupole noise radiation is strictly a transonic phenomenon and that it can be suppressed with blade sweep. Noise calculations are presented for two rotors, one simulating a helicopter main rotor and the other a model propeller. For the latter, agreement with test data was substantially improved by including the quadrupole source term. J.M.S.

N78-32834*# George Washington Univ., Washington, D. C. Joint Inst. for Advancement of Flight Sciences.
BOUNDS ON THICKNESS AND LOADING NOISE OF ROTATING BLADES AND THE FAVORABLE EFFECT OF BLADE SWEEP ON NOISE REDUCTION
F. Farassat, Paul A. Nystrom, and Thomas J. Brown (AVRADCOM Res. and Technol. Labs.) *In* NASA. Langley Res. Center Helicopter Acoustics Aug. 1978 p 373-385 refs Sponsored in part by AROD (For primary document see N78-32816 23-71)
(Grant NsG-1474)
Avail: NTIS HC A17/MF A01 CSCL 20A

The maxima of amplitudes of thickness and loading noise harmonics are established when the radial distribution of blade chord, thickness ratio, and lift coefficient is specified. It is first shown that only airfoils with thickness distribution and chordwise loading distributions which are symmetric with respect to midchord need be considered for finding the absolute maxima of thickness and loading noise. The resulting chordwise thickness and load distributions for these maximum noise conditions require infinite slope at some points along the chord but otherwise are uniform. It is shown that sweeping the blades reduces the thickness and loading noise, but there is no optimum sweep which generates the lowest noise. J.M.S.

N78-32835*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A STUDY OF THE NOISE RADIATION FROM FOUR HELICOPTER ROTOR BLADES
Albert Lee (Beam Eng., Inc.) and Marianne Mosher *In* NASA. Langley Res. Center Helicopter Acoustics Aug. 1978 p 387-402 refs (For primary document see N78-32816 23-71)
Avail: NTIS HC A17/MF A01 CSCL 20A

Acoustic measurements were taken of a modern helicopter rotor with four blade tip shapes in the NASA Ames 40-by-80-Foot Wind Tunnel. The four tip shapes are: rectangular, swept, trapezoidal, and swept tapered in platform. Acoustic effects due to tip shape changes were studied based on the dBA level, peak noise pressure, and subjective rating. The swept tapered blade was found to be the quietest above an advancing tip Mach number of about 0.9, and the swept blade was the quietest at low speed. The measured high speed impulsive noise was compared with theoretical predictions based on thickness effects; good agreement was found. J.M.S.

N78-32836*# Pratt and Whitney Aircraft Group, East Hartford, Conn.
FLIGHT EFFECTS ON THE AERODYNAMIC AND ACOUSTIC CHARACTERISTICS OF INVERTED PROFILE COANNULAR NOZZLES Final Report
Hilary Kozlowski and Allan B. Packman Aug. 1978 197 p refs
(Contract NAS3-17866)
(NASA-CR-3018; PWA-5501) Avail: NTIS HC A09/MF A01 CSCL 20A

The effect of forward flight on the jet noise of coannular exhaust nozzles, suitable for Variable Stream Control Engines (VSCE), was investigated in a series of wind tunnel tests. The primary stream properties were maintained constant at 300 mps and 394 K. A total of 230 acoustic data points was obtained. Force measurement tests using an unheated air supply covered the same range of tunnel speeds and nozzle pressure ratios on each of the nozzle configurations. A total of 80 points was taken. The coannular nozzle OASPL and PNL noise reductions observed statically relative to synthesized values were basically retained under simulated flight conditions. The effect of fan to primary stream area ratio on flight effects was minor. At take-off speed, the peak jet noise for a VSCE was estimated to be over 6 PNdB lower than the static noise level. High static thrust coefficients were obtained for the basic coannular nozzles, with a decay of 0.75 percent at take-off speeds. L.S.

N78-32673# Joint Publications Research Service, Arlington, Va.
SOME PRESSING PROBLEMS OF SETTING PHYSIOLOGICAL-HYGIENIC STANDARDS FOR NOISE IN AEROSPACE MEDICINE
Yu. V. Krylov *In its* Space Biol. and Aerospace Med., No. 4 (JPRS-71830) 7 Sep. 1978 p 1-5 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), no. 4, Jul./Aug. 1978 p 3-6 (For primary document see N78-32672 23-51)
Avail: NTIS HC A07/MF A01

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N78-32837*# National Aeronautics and Space Administration, Washington, D. C.
REGISTRATION CHARACTERISTICS OF NEUTRAL PARTICLES WITH POWER 0.6 - 2.0 keV CHANNEL ELECTRON MULTIPLIER WITH FUNNEL
M. A. Gruntman and A. P. Kalinin Sep. 1978 21 p refs Transl. into ENGLISH of "Osobennosti Registratsii Neutralnykh Chastits s Energiyami 0.6 - 2.0 keV Kanalovym Elektronnym Umnozhitelem c Rastrubom", Rept. Pr-311 Inst. of Space Res., Acad. of Sci. USSR, Moscow, 1977 p 1-23 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75540; Pr-311) Avail: NTIS HC A02/MF A01 CSCL 20H

Operating a channel electron multiplier with a VEU-6 funnel shaped opening is studied. Different procedures were used when recording neutral particles. The results obtained make it possible to optimally use the multiplier in actual physical studies. J.M.S.

N78-32838*# National Aeronautics and Space Administration, Washington, D. C.
COMPTON INTERACTION OF FREE ELECTRONS WITH INTENSE LOW FREQUENCY RADIATION
A. F. Illarionov and D. A. Kompaneyets Oct. 1978 32 p refs Transl. into ENGLISH of "Komptonovskoye Vzaimodeystviye Svobodnykh Elektronov s Intensivnym Nizkochastotnym, Izluchen-iyem", Rept. Pr-283 Inst. of Space Res., Acad. of Sci. USSR, Moscow, 1976 p 1-30 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75544; Pr-283) Avail: NTIS HC A03/MF A01 CSCL 20H

Electron behavior in an intense low frequency radiation field, with induced Compton scattering as the primary mechanism of interaction, is investigated. Evolution of the electron energy spectrum is studied, and the equilibrium spectrum of relativistic electrons in a radiation field with high brightness temperature is found. The induced radiation pressure and heating rate of an electron gas are calculated. The direction of the induced pressure depends on the radiation spectrum. The form of spectrum, under the induced force can accelerate electrons to superrelativistic energies is found. Author

N78-32839# Nagoya Univ. (Japan). Inst. of Plasma Physics.
CONDITIONS FOR POPULATION INVERSION OF HYDROGEN-LIKE IONS
Masamoto Otsuka Aug. 1978 19 p refs
(IPPJ-350) Avail: NTIS HC A02/MF A01

Conditions for population inversion are discussed for hydrogen-like ions by means of the collisional-radiative model. Population inversion becomes more noticeable with decreasing electron temperature. For a fixed electron temperature, there are an upper bound for the electron density and a most favorable density. The values of the most favorable density are about 1/3 to 1/10 of those of the upper bound. Comparison with the results observed in He(+) plasma by Sato shows validity of the conditions for

inversion and suggests that increasing the electron density (up to several times as large as that in his experiment) will better favor the population inversion between the levels with the principle quantum number of 2 and 4 and between the levels of 3 and 4. Author

N78-32840# Phrasor Technology, Pasadena, Calif.
MECHANISMS OF EMITTER SURFACE DAMAGE DURING ELECTROHYDRODYNAMIC COLLOID PARTICLE GENERATION AND ACCELERATION Final Report, 1 Feb. 1976 - 31 Jan. 1978
John F. Mahoney, Julius Perel, and Bernard E. Kalensher Mar. 1978 90 p refs
(Contract F44620-75-C-0056; AF Proj. 2308)
(AD-A055622; AFOSR-78-1026TR) Avail: NTIS HC A05/MF A01 CSCL 20/8

This program was directed toward the understanding of the basic colloid thruster generation and acceleration process and the cause of performance degradation. This thruster is applicable for attitude control and stationkeeping on future Air Force satellite missions. A theoretical investigation was made of the process of droplet emission to determine the source of negative ion production causing sputter erosion of the emitter. A model of emitter tip erosion has been developed that correlates with performance degradation. The erosion is caused by back bombardment of the emitter by negative ions produced from the breakup of flow droplets as a result of collisions with fast ions. The calculations were initially made by assuming that the droplets were all the same size rather than using the distribution of droplet sizes actually observed. GRA

N78-32841# Los Alamos Scientific Lab., N. Mex.
TRISTAN 1: TECHNIQUES, CAPABILITIES, AND ACCOMPLISHMENTS
W. L. Talbert, Jr. 1977 24 p refs Presented at the Ames-Brookhaven Workshop on ISOL Systems, Upton, N. Y., 31 Oct. - 1 Nov. 1977
(Contract W-7405-eng-36)
(LA-UR-78-523; Conf-771078-3) Avail: NTIS HC A02/MF A01

Following a brief description of the TRISTAN facility, the techniques developed for on-line nuclear spectroscopy of short-lived fission products, the studies possible, and the activities studied are presented. All journal publications relating to the development of the facility and the studies carried out using it are referenced, and co-workers identified. ERA

N78-32842# Sandia Labs., Livermore, Calif. Gas Dynamics Div.
REAL GAS EQUATION-OF-STATE CAPABILITY AT SANDIA LIVERMORE
G. L. Clark Mar. 1978 344 p refs
(Contract EY-76-C-04-0789)
(SAND-78-8200) Avail: NTIS HC A15/MF A01

A library of FORTRAN routines is described which model the equations-of-state for gases commonly encountered in compressible gas dynamic applications. The present library includes thermodynamic properties packages as well as compressibility models, both for pure gases and mixtures. Tables are included to allow hand calculation of equation-of-state problems for the gases hydrogen, helium, neon, argon, oxygen, air, and nitrogen. Generally the tables extend to several thousand atmosphere, with temperatures from the cryogenic realm to 400 K. ERA

N78-32843# California Univ., Livermore. Lawrence Livermore Lab.
DEFINITION OF TWO BAND PARAMETERS FOR USE IN PHOTON TRANSPORT CALCULATIONS
D. E. Cullen Apr. 1978 14 p
(Contract W-7405-eng-48)
(UCID-17774) Avail: NTIS HC A02/MF A01

The multigroup photon diffusion equations are derived from the Boltzmann equation. Limitations and assumptions imposed by the diffusion equation are thus apparent. In addition, this approach serves to define all the required diffusion parameters in terms of cross section; the relationship to the multi-band parameters used in neutron transport calculations can thus be clearly established. All required two-band parameters are defined in terms of Planckian and Rosseland mean values. Author (ERA)

N78-32844# California Univ., Livermore. Lawrence Livermore Lab.
CROSS SECTION PROBABILITY TABLES IN MULTIGROUP TRANSPORT CALCULATIONS
D. E. Cullen, E. F. Plechaty, R. J. Doyas, C. R. Weisbin, and J. E. White Mar. 1978 27 p refs Presented at Radiation Shielding Inform. Center Seminar, Oak Ridge, Tenn., 14 Mar. 1978
(Contract W-7405-eng-48)
(UCRL-80655; Conf-780334-1) Avail: NTIS HC A03/MF A01

The use of cross section probability tables in multigroup transport calculations is presented. Emphasis is placed on how probability table parameters are generated in a multigroup cross section processor and how existing transport codes must be modified to use them. In order to illustrate the accuracy obtained by using probability tables, results are presented for a variety of neutron and photon transport problems. ERA

N78-32845# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
COHERENCE AND RELAXATION IN ENERGY TRANSFER PROCESSES IN CONDENSED PHASES Ph.D. Thesis
Robert McKinnon Shelby Mar. 1978 239 p refs
(Contract W-7405-eng-48)
(LBL-7339) Avail: NTIS HC A11/MF A01

Investigations of electronic triplet and vibrational energy transfer dynamics and relaxation processes are presented. Emphasis is placed on understanding the role of coherence and interactions which tend to destroy the coherence. In the case of triplet excitons at low temperatures, the importance of coherence in energy migration can be established, and the average coherence parameters can be experimentally determined. In the case of vibrational excitations, both picosecond spectroscopic studies of vibrational relaxation and spontaneous Raman spectroscopy are used to characterize the dynamics and give increased insight into the nature of the mechanisms responsible for vibrational dephasing. The design and operation of the picosecond apparatus used in these experiments is also described. ERA

N78-32846# Sandia Labs., Albuquerque, N. Mex.
VARIABLE-TEMPERATURE SAMPLE SYSTEM FOR ION IMPLANTATION AT -192 TO +500 DEG C
C. T. Fuller Apr. 1978 17 p refs
(Contract EY-76-C-04-0789)
(SAND-78-0520) Avail: NTIS HC A02/MF A01

A sample system based on exchange-gas coupling and developed for ion-implantation can be controlled from -192 C to +500 C with rapid cooling. The system also has provisions for focusing and alignment of the ion beam, electron suppression, temperature monitoring, sample current measuring, and cryo-shielding. Design considerations and operating characteristics are discussed. ERA

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N78-32847 North Carolina State Univ. at Raleigh
MATHEMATICAL MODELS FOR INTERELEMENT AND MATRIX EFFECTS IN X-RAY FLUORESCENCE ANALYSIS Ph.D. Thesis
Alan Roy Hawthorne 1977 190 p
Avail: Univ. Microfilms Order No. 7811589

The Monte Carlo method was used to simulate the X-ray fluorescence process. The Monte Carlo model developed has great flexibility in its ability to simulate various system geometries and sample shapes and thicknesses. For routine elemental analysis of thick samples with a wide-angle XRF system, the

concept of using Monte Carlo determined response weighted mean angles was developed. These mean angles can then be used in conjunction with fixed-angle analytical equations to describe the interelement effects. Also investigated were the effects of absorption and enhancement in particulate samples collected on filters. Correction factors were developed to account for these non-linear effects. Finally, the effect of particle size on the response to a thick heterogeneous sample was investigated and an empirical model was proposed to predict the response variations due to particle-size effects. Dissert. Abstr.

N78-32848* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

METHOD AND APPARATUS FOR SPLITTING A BEAM OF ENERGY Patent

Walter Robert Leeb, inventor (to NASA) (National Academy of Sciences) Issued 6 Jun. 1978 13 p Filed 23 Dec. 1975 Supersedes N76-15451 (14 - 06, p 0721)
(NASA-Case-GSC-12083-1; US-Patent-4,093,354; US-Patent-Appl-SN-643897; US-Patent-Class-350-320; US-Patent-Class-350-170; US-Patent-Class-350-173; US-Patent-Class-350-174; US-Patent-Class-350-286) Avail: US Patent Office CSCL 20H

A wedge shaped beam splitting device is described which has a first surface for splitting an incident beam energy into an externally reflected beam and an internally transmitted beam, a second surface spaced from the first surface splits the internally transmitted beam into an externally transmitted beam and into an internally reflected beam, and intersects the first surface at an angle that impinges the internally transmitted beam on the second surface at an angle of incidence that is less than the minimum angle necessary for substantially total internal reflection and impinges the internally reflected beam on the first surface at an angle of incidence that exceeds the minimum angle necessary for substantially total internal reflection. The device may also be used as a beam combiner.

Official Gazette of the U.S. Patent Office

N78-32849# Ballistic Research Labs., Aberdeen Proving Ground, Md.

ANALYSIS OF TRANSMISSION-LINE ACCELERATOR CONCEPTS Final Report, Nov. 1976 - Sep. 1977

J. K. Temperley and D. Eccleshall May 1978 58 p refs
(DA Proj. 1T1-61101-A-91A)
(AD-A056364; AD-E430056; ARBRL-TR-02067) Avail: NTIS HC A04/MF A01 CSCL 20/7

An analysis is presented of charged transmission-line configurations for use in high-current accelerators. Basic drawbacks of the symmetric radial-pulse-line design are identified. The concept of using asymmetric pairs of transmission lines of various geometries is introduced. Conditions for maximum efficiency and maximum energy transfer to the beam load are derived for ideal constant-impedance lines. It is shown that, in the lossless-line approximation, asymmetric line-pair configurations exist with which both a high accelerating voltage per stage and nominal unit efficiency can be achieved. A recirculating accelerator is described, in which advantage is taken of a repetitive voltage waveform present in the transmission-line cavities to repeatedly accelerate a current pulse which is recirculated through the accelerator. Expressions for the open-circuit output voltage, accelerating voltage per stage, and efficiency of energy transfer to the beam are derived for this case also. It is shown that, with proper choice of parameters, this type of design again affords the possibility of nominal unit efficiency for energy transfer to the beam. Author (GRA)

N78-32850# California Univ., Livermore. Lawrence Livermore Lab.

STABLE PROPAGATION OF AN ELECTRON BEAM IN GAS

E. P. Lee, F. W. Chambers, L. L. Lodestro, and S. S. Yu 30 Sep. 1977 13 p refs Presented at 2d Intern. Topical Conf.; Ithaca, N. Y., 3 Oct. 1977
(Contract W-7405-eng-48)
(UCRL-79886; Conf-771035-9) Avail: NTIS HC A02/MF A01

Conditions for the stable propagation of a pinched electron beam in low pressure gas (p approximately 0.1 to 100 torr) are described. The observed window of good propagation around p approximately 2 torr air is interpreted as the quenching of the two-stream mode by sufficiently high plasma density and collision frequency, and the simultaneous suppression of the resistive hose mode by sufficiently rapid generation of electrical conductivity from breakdown ionization. ERA

74 OPTICS

Includes light phenomena.

N78-32851 Johns Hopkins Univ., Baltimore, Md.

OPTICAL AND PIEZOELECTRIC DETECTION OF ACOUSTIC EMISSION SIGNALS Ph.D. Thesis

Ronald Alan Kline 1978 137 p
Avail: Univ. Microfilms Order No. 7811778

Waveforms and frequency spectra of stress waves detected simultaneously by interferometric and piezoelectric methods were compared in order to assess the relative merits of the two techniques. For simulated acoustic events where the generating function closely approximated a step impulse in stress directed normal to the specimen surface, the normal component of the surface displacement detected by the optical interferometer was found to closely agree with seismic theory predictions for several different geometries. Interferometric response to simulated and naturally occurring events was compared to evaluate the nature of the acoustic emission source generation mechanism.

Dissert. Abstr.

N78-32852 Virginia Univ., Charlottesville.

DISCRETE OPTICAL SENSOR RESOLUTION ENHANCEMENT Ph.D. Thesis

Karl Crenshaw Henderson 1977 68 p
Avail: Univ. Microfilms Order No. 78-12094

A method for improving the resolution obtainable from discrete optical sensors of a given size is presented. The method uses a scan technique in which samples are overlapped both horizontally and vertically. The samples are then processed to obtain a sampled image with better resolution than could be obtained with sensors of the given size using normal scan and processing methods. Two methods for processing the samples are described. The first is an application of the generalized theory of linear equations using the Moore-Penrose pseudoinverse. Methods for taking advantage of extreme sample values and a priori information are discussed. The second method is based on recursive models of the image and sampling process. The image model is developed by application of nearest neighbors, approximation.

Dissert. Abstr.

N78-32853 California Univ., Berkeley.

VISUAL MODELS AND THE DESIGN OF IMAGE PROCESSING FILTERS Ph.D. Thesis

Toma Ioan Hentea 1977 132 p
Avail: Univ. Microfilms Order No. 7812599

For the class of images containing high-contrast edges it is shown that the errors produced by filtering are first detected around the edges. Based on this result a new formulation of the filter design problem involving both space and frequency domain specifications is given. The threshold perception of distortion in filtered images was studied by using edges as test images. The visibility of errors in the vicinity of edges is shown to be highly dependent on the masking effect. The structure of a model for detection of distortion in complex images is proposed. A weighted least squares design method was developed for both continuous and digital filter design. A methodology of design is discussed and examples of lowpass digital filters are given. A similar approach was taken for the design of image processing filters by linear programming. Dissert. Abstr.

N78-32854* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

PROCESS FOR PRODUCING A WELL-ADHERED DURABLE OPTICAL COATING ON AN OPTICAL PLASTIC SUBSTRATE Patent

Ronald M. Kubacki, inventor (to NASA) (Bell and Howell, Chicago) Issued 20 Jun. 1978 7 p Filed 15 Dec. 1976 Sponsored by

NASA
(NASA-Case-ARC-11039-1; US-Patent-4,096,315; US-Patent-Appl-SN-750655; US-Patent-Class-428-412; US-Patent-Class-351-166; US-Patent-Class-427-38; US-Patent-Class-427-41; US-Patent-Class-427-44; US-Patent-Class-427-164; US-Patent-Class-427-302; US-Patent-Class-427-322; US-Patent-Class-427-387; US-Patent-Class-428-447) Avail: US Patent Office CSCL 20F

A low temperature plasma polymerization process is described for applying an optical plastic substrate, such as a polymethyl methacrylate lens, with a single layer abrasive resistant coating to improve the durability of the plastic.

Official Gazette of the U.S. Patent Office

N78-32855*# National Aeronautics and Space Administration, Washington, D. C.

SIMULTANEOUS IMAGE REPRODUCTION ON CRT SCREEN: MOVES ULTRASONIC SECTIONAL VIEW AND ELECTROCARDIOGRAM CURVES

Aug. 1978 25 p Transl. into ENGLISH from German Patent No. P2577094.2, Appl. 2 Oct. 1975, 26 May 1976 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Kretztechnik GmbH, Zipf, Austria
(Contract NASw-3199)
(NASA-TM-75343; Doc-25-44-094) Avail: NTIS HC A02/MF A01 CSCL 20F

A method for simultaneous reproduction of images, requiring different amounts of time to reproduce, on a cathode ray tube (CRT) screen is disclosed. Ultrasonic sectional views and electrocardiogram curves are simultaneously reproduced on the CRT screen by producing the images on different areas of a screen with two phosphors having different persistence times and luminous colors, within the times required for the appearance of the images. In front of the area on which is produced the image requiring the shorter time is a color filter which is permeable to the color of the phosphor with the shorter persistence time by which absorbs the color of the other phosphor. J.M.S.

N78-32856*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

PEAKER: AN AUTOMATIC BORESIGHT PEAKING ROUTINE FOR THE C-141 TELESCOPE

Edwin F. Erickson, Kevin Krisciunas (Informatics, Inc., Palo Alto, Calif.), and Thomas Mathieson (Informatics, Inc., Palo Alto, Calif.) Sep. 1978 8 p
(NASA-TM-78516; A-7584) Avail: NTIS HC A02/MF A01 CSCL 20F

The operation of an automated procedure is detailed which maximizes the signal from a detector by pointing the telescope at an astronomical source. G.G.

N78-32857*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

DIFFRACTOID GRATING CONFIGURATION FOR X-RAY AND ULTRAVIOLET FOCUSING Patent Application

Sidney O. Kastner, inventor (to NASA) Filed 18 Sep. 1978 16 p
(NASA-Case-GSC-12357-1; US-Patent-Appl-SN-943089) Avail: NTIS HC A02/MF A01 CSCL 20F

An asperic concave diffraction surface grating is reported that produces a stigmatic image of a designated wavelength at grazing angles of incidence. The reflecting surface grating does not have a constant radius but is a surface of revolution defined by a non-linear differential equation specified in terms of a selected grating parameter. NASA

N78-32858*# Rockwell International Science Center, Thousand Oaks, Calif.

THE 1.06 OPTICAL RECEIVER Final Project Report

L. R. Tomasetta, H. D. Law, K. Nakano, F. W. Scholl, and J. S. Harris, Jr. 13 Feb. 1978 83 p refs
(Contract NAS5-23862)
(NASA-CR-156820; SC5094.25FPR) Avail: NTIS HC A05/MF A01 CSCL 20F

High performance 1.06 micron m avalanche photodetectors (APDs), fabricated in the GaAlSb system, have high quantum efficiency (90 percent), high speed (risetime less than 60 ps) and low leakage currents (less than 50 na). The dark current represents more than an order of magnitude reduction compared to previously reported results. The high speed avalanche gain of these devices is between 20 and 50. The area uniformity is better than + or - 10 percent. GaAlAs APDs at 0.53 micron m have even faster speed, lower dark currents, and high speed gains of 100 to 200. Optical rangefinders based on measured APD performance parameters have far superior performance when compared to even ideal photomultiplier tubes in either a one color or two color rangefinder system. For a one color system, f factor of two lower time jitter can be achieved with identical transmitted power. The superiority of the APD based two color receiver is significant and exists in the entire range of desired time jitters (less than 100 ps) and received power levels. A.R.H.

N78-32859# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

A THEORETICAL ANALYSIS OF CHANGES IN THERMAL SIGNATURES CAUSED BY PHYSICAL AND CLIMATOLOGICAL FACTORS M.S. Thesis

John T. Small, Jr. Dec. 1977 273 p refs
(AD-A055642; AFIT/GEP/PH/77-12) Avail: NTIS HC A12/MF A01 CSCL 17/5

An investigation of the thermal signatures of natural objects is undertaken. Using the principle of energy balance, diurnal temperature models are developed for the ground, a vehicle (such as a tank), and the leaves of a tree. These models are included in a computer program designed to simulate daily variations in conductive, radiative, and convective heat transfer processes. Environmental conditions are changed by altering the program inputs, which include: latitude, day, wind speed, mean air temperature, cloud type, total insolation, absolute and relative humidity, atmospheric pressure, and particular concentration. The program is iterated for several values of a single parameter such as one of the environmental inputs, or one of 21 physical characteristics of the models (for example; ground reflectivity, tank thickness, or leaf transpiration rate). There are two types of output from the program; simultaneous plots of the temperatures of all the models for a 30 hour period, and curves representing 24 hour periods of the temperature difference (Delta T) between the tank and the ground. The effects of changing a parameter are analyzed by comparing the various Delta-T curves. GRA

N78-32860# HSS, Inc., Bedford, Mass.

DEVELOPMENT OF A HIGH-RESOLUTION IMAGE INTENSIFIED SPECTROGRAPH Final Report, 10 Nov. 1975 - 30 Apr. 1977

A. H. Tuttle 19 Apr. 1977 25 p refs
(Contract DNA001-76-C-0097)
(AD-A055928; AD-E300225; HSS-B-032; DNA-4408F) Avail: NTIS HC A02/MF A01 CSCL 17/5

This instrument was developed to provide high resolution spectral information of low light level optical radiation from atomic and molecular species related to the infrared chemistry of the upper atmosphere when excited by electron bombardment from a rocket-borne electron accelerator. Author (GRA)

N78-32861# Parke Mathematical Labs., Inc., Carlisle, Mass.

TOPICS IN OPTICAL MATERIALS AND DEVICE RESEARCH Final Technical Report, Sept. 1976 - Sep. 1977

Dean Bandes, Theodore B. Barrett, John J. Brule, Charles E. Ryan, and Stanford P. Yukon Mar. 1978 134 p refs
(Contract F19628-77-C-0037)
(AD-A055432; RADC-TR-78-61) Avail: NTIS HC A07/MF A01 CSCL 17/5

This final report consists of 4 diverse parts: a summary with references of theoretical modeling of multiphonon infrared absorption and modeling of some signal transmission properties of optical fibers; a synopsis of 2 reports which describe and summarize the IR Laser Window Project and IR Imaging Project at RADC/ES; a synopsis of charge coupled devices and related technologies and its significance to some Air Force systems; and a description of CDC6600 software for reduction of Fourier spectrometer measurements from a Digilab, Inc. FTS14.

Author (GRA)

N78-32862# Florida Univ., Gainesville. Dept. of Electrical Engineering.
LIGHT SCATTERING FROM IRREGULAR DIELECTRIC PARTICLES Final Report, 1 Mar. 1975 - 28 Feb. 1978
Gray Ward 28 Mar. 1978 177 p refs
(Grant DAHC04-75-G-0100)
(AD-A055835; ARO-12178.1-GS) Avail: NTIS HC A09/MF A01 CSCL 20/3

A digital polar nephalometer has been constructed to measure the intensity and polarization of light pulses scattered into 94 angles from 9 to 176 deg from monodisperse aerosol particles of controlled shape. The light source was a tunable dye laser giving 10 kW 4 ns pulses, operated at 627 nm. Calibration data from polystyrene latex spheres agrees with Mie theory within about 10%. Data for spheroidal 2 micrometers cladosporium and quasi-cubical 4 micrometers NaCl particles are shown. It is found that the backscatter from non-spherical particles (of size parameter about 10) differs significantly from that for the best fit sphere, so that a tumbled irregular particle is not equivalent to a sphere. GRA

N78-32863# Argonne National Lab., Ill.
EVALUATION OF ON-LINE LIGHT-SCATTERING OPTICAL PARTICLE ANALYZERS FOR MEASUREMENTS AT HIGH TEMPERATURE AND PRESSURE
J. C. Montagna, G. W. Smith, F. G. Teats, G. J. Vogel, and A. A. Jonke Feb. 1978 34 p refs
(Contract W-31-109-eng-38)
(ANL/CEN/FE-77-7) Avail: NTIS HC A03/MF A01

Two light-scattering particle size analyzers were tested at ANL in the process development unit (PDU) fluidized-bed combustion system. The analyzers are (1) a single-particle analyzer developed by Spectron Development Laboratory and (2) a multiparticle analyzer developed by Leeds and Northrup. Particle size distributions and mass loadings determined at different flue gas duct locations with the two instruments were compared with those obtained with (1) an Andersen cascade impactor, (2) a Coulter counter, and (3) positive filters. These comparisons were used to evaluate the two instruments at their present state of development. ERA

N78-32864# California Univ., Livermore. Lawrence Livermore Lab.
INFORMATION TRANSMISSION VIA FIBER OPTICS IN THE SHIVA LASER CONTROL SYSTEM
J. Parker 6 Feb. 1978 16 p refs
(Contract W-7405-eng-48)
(UCID-17771) Avail: NTIS HC A02/MF A01

The Fiber Optic Serial Link package performs the functions of transmission and reception of signals over a pair of fiber optic cables and the I/O of serial data to a local device in EIA format. Systems requirements include fiber cable transmission length of up to 150 m and baud rates up to 9600, although the design criterium of transmission at 19.2 KB was met. Fiber optic links are used between the central control area and each of the alignment control subsystems, in addition to sending timing signals over long distances between subsystems. ERA

N78-32865# Illinois Univ., Urbana. Materials Research Lab.
STUDIES OF THE OPTICAL PROPERTIES OF SOLIDS. 1: TWO-PHOTON ELECTROABSORPTION. 2: ELECTRON-HOLE EXCHANGE COUPLING AT L-II, L-III EDGES Ph.D. Thesis
M. A. Kolber 1978 168 p refs
(Contract EY-76-C-02-1198)
(COO-1198-1206) Avail: NTIS HC A08/MF A01

Direct-gap covalent seminconductors, such as GaAs, should exhibit electric-field induced Franz-Keldysh-like structures in their two-photon absorption spectra. These structures are evaluated employing excition theory; the resulting lineshapes are shown to be proportional to the lineshapes for one-photon forbidden transitions, a property which greatly facilitates computations of the two-photon absorption. Exchange mixes the L/sub II/and L/sub III/ soft X-ray absorption edges of metallic Na, Mg, and Al, affecting the detailed absorption lineshape and the L/sub II/L/sub III/intensity ratio. The Onodera theory of this mixing is generalized and the requirements of particle conservation and causality lead to significant modifications of the theoretical absorption lineshape. Under certain conditons an exchange-free lineshape can be extracted from experimental data for comparison with non asymptotic theories of X-ray edges. ERA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N78-32866 Maryland Univ., College Park.
COMPUTER SIMULATIONS OF NONLINEAR STABILIZATION OF THE BEAM PLASMA INSTABILITY Ph.D. Thesis
Harvey Lynn Rowland 1977 217 p
Avail: Univ. Microfilms Order No. 78-13876

A new, large scale plasma simulation code was developed that uses a hybrid representation to describe the plasma. Computer simulations of the kinetic warm beam instability with finite mass ions are reported. Most of the energy lost by the beam is shown to heat the background electrons by forming suprathermal power law tails. Tail formation is studied for situations where the initial electron distribution is Maxwellian. Simulations are also reported where such tail formation can help explain the electron flux spectrum observed in auroras. A theoretical model is presented showing the effects of finite amplitude ion cavities on the dc conductivity of a collisionless one dimensional plasma. The theoretical predictions are compared with both particle and Vlasov computer simulations. Dissert. Abstr.

N78-32867 California Univ., Berkeley.
STOCHASTIC ACCELERATION BY A SINGLE WAVE IN A MAGNETIZED PLASMA Ph.D. Thesis
Gary Richard Smith 1977 241 p
Avail: Univ. Microfilms Order No. 78-12780

Stochasticity in the motion of a charged particle in a uniform magnetic field and a single wave was studied. This wave-particle interaction shows the following features: An electrostatic wave propagating obliquely to the magnetic field causes stochastic motion if the wave amplitude exceeds a certain threshold. The overlap of cyclotron resonances then destroys a constant of the motion, allowing strong particle acceleration. The stochastic motion resembles a diffusion process even though the wave spectrum contains only a single wave. The motion of ions in a nonuniform magnetic field and a single electrostatic wave was treated as a possible saturation mechanism of the dissipative trapped-ion instability in a Tokamak. Ions in a layer near the trapped-circulating boundary move stochastically. This motion leads to nonlinear stabilization mechanisms. Dissert. Abstr.

N78-32868 Stanford Univ., Calif.
INSULATING WALL BOUNDARY LAYER IN A FARADAY MHD GENERATOR Ph.D. Thesis
Roy R. Rankin 1978 129 p
Avail: Univ. Microfilms Order No. 7814201

The velocity profile at the center of the insulating wall in an MHD generator was measured using a dual beam real fringe anemometer system with an argon ion laser. The analytic model involved the computer solution, using finte difference techniques, of the momentum, energy, and electrical equations including MHD effects for the turbulent insulating wall boundary layer. The turbulence model used was the mixing length theory which was modified to include turbulence damping. Variable, equilibrium properties were employed producing a coupling between the momentum, energy, and electrical equations resulting in extended Hartmann flow. Calculations for a supersonic generator indicate that turbulence damping is unimportant, but that extended Hartmann flow causes a reduction in both the skin friction and the heat transfer and could lead to separation of the insulating wall boundary layer. Dissert. Abstr.

N78-32869# Nagoya Univ. (Japan). Inst. of Plasma Physics.
RADIATION PHENOMENA OF PLASMA WAVES. PART 2: RADIATION FROM POINT SOURCES
Toshiro Ohnuma Jun. 1978 73 p refs
(IPPJ-337-Pt-2) Avail: NTIS HC A04/MF A01

Topics covered include: (1) radiation of plasma waves from

a point source in isotropic plasma; (2) radiation of electrostatic electron waves in anisotropic plasma (electron plasma waves, electron cyclotron harmonic waves, and upper hybrid waves); (3) radiation of ion electrostatic ion waves in anisotropic plasma (low frequency resonance cone, neutralized ion Bernstein waves, and lower hybrid wave); (4) radiation of electromagnetic waves in anisotropic plasma (whistler and electron cyclotron waves, quasistatic electron waves, and reflection of the high frequency resonance cone; (5) radiation of electromagnetic ion waves in anisotropic plasma; and (6) radiation in a plasma stream. A.R.H.

N78-32870# Nagoya Univ. (Japan). Inst. of Plasma Physics.
RADIATION PHENOMENA OF PLASMA WAVES. PART 3: RADIATION FROM FINITE SOURCES
Toshiro Ohnuma Jun. 1978 61 p refs
(IPPJ-338-Pt-3) Avail: NTIS HC A04/MF A01

The excitation of plasma waves from monopole, dipole, double plasma, modulated beam, instability, and nonlinear type sources is reviewed. The practical use of each excitor is discussed and the results of finite size effects on radiation patterns are examined. A.R.H.

N78-32871# Nagoya Univ. (Japan). Inst. of Plasma Physics.
KINETIC EFFECTS ON THE CONVECTIVE PLASMA DIFFUSION AND THE HEAT TRANSPORT
H. Naitou, T. Kamimura, and J. M. Dawson Jun. 1978 36 p refs
(IPPJ-339) Avail: NTIS HC A03/MF A01

Cross field heat and particle transport due to the thermally excited convective cell mode is investigated both by theoretical work and by particle simulations. A parameter range exists where the heat diffusion coefficient is considerably less than the particle diffusion coefficient. This comes from the fact that high energy particles in a velocity distribution diffuse much more slowly than the low energy particles, because the fluctuating electric fields are averaged out over their finite Lamor radii. A velocity dependent diffusion coefficient is obtained by a simple theory, together with an estimate of the heat diffusion coefficient. Good agreement with the simulation results is obtained. The magnetic field scaling of heat diffusion/particle diffusion coefficients is also discussed. The results imply that ions in a thermonuclear reactor should be less affected by turbulence than are electrons, as appears to be the case. A.R.H.

N78-32872# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ELECTROSTATIC LOW-FREQUENCY INSTABILITY OF CYLINDRICAL TOKAMAK
Sanae Inoue, Kimitaka Itoh, and Shoichi Yoshikawa Jun. 1978 42 p refs
(IPPJ-340) Avail: NTIS HC A03/MF A01

A comprehensive theory is presented for the electrostatic low frequency instabilities of a collisionless plasma in a cylindrical Tokamak. The plasma carries a longitudinal current which produces the poloidal magnetic field and the magnetic shear. The effects of inhomogeneities (density, electron and ion temperature gradients), plasma current, radial electric field and the magnetic shear were examined. The instabilities are found to be excited owing to the plasma current, ion temperature gradient and radial electric field, though the magnetic shear has a prominent stabilization power. The off resonant instability in the absence of the magnetic shear is also discussed. G.G.

N78-32873# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ELECTRON CYCLOTRON HEATING FOR BUMPY TORUS
H. Ikegami (ORNL) and R. A. Dandl (ORNL) Jul. 1978 29 p refs
(IPPJ-343) Avail: NTIS HC A03/MF A01

Electron cyclotron heating is reviewed from the viewpoint of experiments on the Elmo Bumpy Torus. Some of the coupling processes of microwave power to plasma are considered and the generation of energetic electrons is explained as a distinguishing feature of microwave discharge plasmas in the bumpy torus configuration. Some discussion on the technology for the successful application of high power millimeter microwaves to the heating of fusion plasmas is made. In Appendix, experimental results are presented from the Elmo Bumpy Torus. Author

N78-32874# Nagoya Univ. (Japan). Inst. of Plasma Physics.
NONLINEAR PROPAGATION OF THE EXTRAORDINARY MODE IN A HOT MAGNETOPLASMA
Tu Khiet (Paris-Sud Univ.), Y. Furutani (Okayama Univ.), and Y. H. Ichikawa Jul. 1978 24 p refs
(IPPJ-344) Avail: NTIS HC A02/MF A01

Kinetic theory for a nonlinear propagation of quasi-monochromatic extraordinary waves reveals that propagation of an envelope of the extraordinary carriers is described by the nonlinear Schrodinger equation. In a cold plasma limit, a detailed analysis is carried out on a behavior of the envelope of the upper- and the lower-hybrid waves at respective resonant frequency ranges. A.R.H.

N78-32875# Nagoya Univ. (Japan). Inst. of Plasma Physics.
TOPICS ON SOLITONS IN PLASMAS
Yoshi H. Ichikawa Jul. 1978 47 p refs Presented at the Chalmers Symp. on Solitons, Goeteborg, 7-14 Jun. 1978
(IPPJ-345) Avail: NTIS HC A03/MF A01

Solitons can be regarded as nonlinear normal modes, in terms of which dynamical properties of a given physical system could be analyzed. The cnoidal wave is the genuine nonlinear wave playing important roles in nonlinear phenomena in plasmas and other dispersive media. Explicit analysis for the ion acoustic cnoidal wave is carried out up to the second order on the basis of a renormalized reductive perturbation theory. The nonlinear ion flux associated with the cnoidal wave exhibits profound frequency dependence which is not predicted by quasi-linear treatment. Bogoliubov-Mitropolsky perturbation analysis of the perturbed envelope soliton is discussed in referring to Karpman-Maslov's perturbation approach based on the inverse scattering method. Summaries on plasma waves in magnetized plasmas are followed by a report on the inverse scattering scheme for the derivative nonlinear Schrodinger equation. A.R.H.

N78-32876# Nagoya Univ. (Japan). Inst. of Plasma Physics.
END PLUGGING OF A LINEAR THETA PINCH BY PULSED MIRRORS
Amiyak Sen Jul. 1978 13 p refs
(IPPJ-346) Avail: NTIS HC A02/MF A01

By suitably pulsing a magnetic mirror end plug of a linear theta pinch, end loss can be substantially reduced. A system consisting of a linear pinch with sequentially pulsed multimirror end plugs is proposed which shows promise of fusion feasibility. A.R.H.

N78-32877# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ACOUSTIC TURBULENCE TRAPPED IN THE MODULATED LANGMUIR WAVE AND ITS EFFECT ON THE COLLAPSE
Ken Kogiso, Mitsuo Kono, and Nobuo Yajima Aug. 1978 31 p refs
(IPPJ-348) Avail: NTIS HC A03/MF A01

The possibility that the collapse of a long coherent Langmuir wave is suppressed by the effect of acoustic turbulence is demonstrated. The local depletion of the plasma density caused by the pondermotive force of the lone coherent Langmuir wave makes the parametric instability possible, and leads to the excitation of the turbulent ion acoustic waves and turbulent plasma waves which are trapped in the modulated Langmuir wave. The scattering of the Langmuir wave by the turbulent waves is effective to the stabilization of the modulation instability as the turbulent energy is increased. The condition for the suppression of the collapse is examined. Author

N78-32878# Nagoya Univ. (Japan). Inst. of Plasma Physics.
AN OPTIMIZATION OF PLASMA CROSS SECTION FROM A POINT OF VIEW OF ALPHA PARTICLE CONFINEMENT
Kazunari Ikuta Jul. 1978 21 p refs
(IPPJ-351) Avail: NTIS HC A02/MF A01

Axisymmetric toroidal configurations are optimized from the view point of alpha particle confinement. In particular, an elliptically deformed configuration with multifold magnetic axes and low aspect ratio limit of tori are investigated. Elliptic deformation can render absolute confinement of alpha particle harder. Low-aspect-ratio limit of the configuration can be absolute container of alphas at the price of necessary toroidal current. The optimized cross section in this limit is an oblate rectangle (the ratio between the width and the height being equal to

1.22) and the necessary toroidal current to marginally confine all the alpha particles produced near the magnetic axis is 6 MA. Author

N78-32879# Stanford Univ., Calif. Gasdynamics Lab.
MEASUREMENTS OF ELECTRICAL CONDUCTIVITY MHD PLASMAS WITH FOUR-PIN PROBES Progress Report, 15 Feb. 1976 - 14 Feb. 1978
Nelson L. Hower 15 Feb. 1978 131 p refs
(Contract F44620-76-C-0024; AF Proj. 2308)
(AD-A055392 SU-HGL-108; AFOSR-78-0847TR) Avail. NTIS HC A07/MF A01 CSCL 20/9

This work describes the development of a four-pin probe and associated electronic instrumentation for making time and space resolved measurements of electrical conductivity in MHD plasma flows. Measurements were made in 2000 K atmospheric-pressure potassium-seeded (0.1% by weight) argon flowing at velocities between 10 and 100 meters/sec. The results show a dependence of indicated conductivity on flow speed and probe orientation, so that calibration is necessary for high accuracy absolute conductivity determinations. The probe is well suited for time and space resolved relative conductivity fluctuation measurements, and for continuous display of time-averaged indicated conductivity. Author (GRA)

N78-32880# Naval Research Lab., Washington, D. C. Plasma Dynamics Branch.
USE OF MULTIPLE PHOTOEXCITATION IN AN OPTICALLY THICK SILICON-ALUMINUM PLASMA TO OBTAIN LASING AT 44 A Interim Report
J. P. Apruzese (Sci. Appl., Inc., Arlington, Va.), K. G. Whitney (Sci. Appl., Inc., Arlington, Va.), and Jack Davis Apr. 1978 27 p refs Sponsored by Defense Nucl. Agency
(AD-A056358; AD-E000176; NRL-MR-3760) Avail: NTIS HC A03/MF A01 CSCL 20/9

It is a well established phenomenon of radiative transfer in stellarlike plasmas that as the optical depth of a line increases, the mean radiative energy flux in the line correspondingly increases to approach the Planck blackbody value. Recently, the possibility of achieving stimulated emission in the X-ray or soft X-ray region by utilizing the interaction of strong lines from different elements or neighboring ionization stages has been considered in the context of resonance line pumping in high density, albeit optically thin, plasmas. Proper utilization of photon trapping effects in the pumped and pumping plasmas can yield comparable gains at soft X-ray frequencies to those proposed, however, at plasma densities that are significantly below and over spatial extents that are significantly larger than those that would be required were one to be restricted to optically thin plasmas in which an exponentially decaying inversion density is generated. The demonstration is made by treating the physical situation of a non-collisionally dominated aluminum plasma with the aid of a new global rate equation formalism developed to include photoexcitation processes, on the average, into ionization equilibrium calculations involving optically thick laboratory plasmas. GRA

N78-32881# California Univ., Livermore. Lawrence Livermore Lab.
BEAM TRANSPORT OPTICS FOR LASER FUSION
A. J. Glass Oct. 1977 17 p refs Presented at 21st Ann. Tech. Symp. of the Soc. of Photo-Optical Instrumentation, San Diego, Calif., 22 Aug. 1977
(Contract W-7405-eng-48)
(UCRL-80170; Conf-770868-3) Avail: NTIS HC A02/MF A01

The performance of large laser systems for laser fusion is limited by self-induced damage to optical components, arising from the interaction of the intense light with the optical materials in the laser system. In the design of the beam transport optics, due consideration must be given to high intensity effects, including self-focusing, surface damage, and internal reflection focusing. The constraints imposed on the design of optical components by these considerations are discussed. ERA

N78-32882# California Univ., Livermore. Lawrence Livermore Lab.
STIMULATED RAMAN SCATTER IN LASER FUSION TARGET CHAMBERS
J. J. Thomson 17 Oct. 1977 19 p refs Presented at Ann. Am. Phys. Soc. Meeting, Atlanta, Ga., 7 Nov. 1977
(Contract W-7405-eng-48)
(UCRL-80233; Conf-771136-3) Avail: NTIS HC A02/MF A01

The target chamber of a laser fusion reactor contains small amounts of background gases. As the beam is focused, it ionizes the gas and Raman scattering is induced. Density limits on the background gas are found in order that the laser beam will not become appreciably decollimated. It is shown that laser bandwidth efficiently decreases the scattering effect. ERA

N78-32883# California Univ., Livermore. Lawrence Livermore Lab.
EQUILIBRIUM STATISTICAL MECHANICS OF STRONGLY COUPLED PLASMAS BY NUMERICAL SIMULATION
H. E. DeWitt Nov. 1977 [illegible] refs
(Contract W-7405-eng-48)
(UCRL-80323) Avail: NTIS HC A04/MF A01

Numerical experiments using the Monte Carlo method for determining the thermodynamic properties of strongly coupled one-component plasmas and mixtures of two nuclear components are described. Simple analytic expressions for the equation of state and other thermodynamic functions were obtained in which there is a clear distinction between a lattice-like static portion and a thermal portion. The thermal energy for the one-component plasma has a simple power dependence on temperature that is identical to Monte Carlo results obtained for strongly coupled fluids governed by repulsive l/r/sup n/ potentials. For two-component plasmas the ion-sphere model is shown to accurately represent the static portion of the energy. Electron screening was included in the Monte Carlo simulations using linear response theory and the Lindhard dielectric function. Free energy expressions were constructed for one and two component plasmas that allow easy computation of all thermodynamic functions. ERA

N78-32884# California Univ., Livermore. Lawrence Livermore Lab.
PLASMA PRODUCTION AND FLOW IN NEGATIVE ION BEAMS
O. A. Anderson and E. B. Hooper, Jr. 21 Sep. 1977 7 p refs Presented at Symp. on the Production and Neutralization of Negative Hydrogen Ions and Beams, Upton, N. Y., 26 Sep. 1977
(Contract W-7405-eng-48)
(UCRL-80099; Conf-770940-5) Avail: NTIS HC A02/MF A01

Plasma generated in low-density vapor by a negative ion beam was studied experimentally and computationally. It is shown that space charge neutralization of the beam occurs at very low vapor density, and that correspondingly the electron density may be much less than the beam and plasma ion densities. When there is a large local gas density, as in a charge changing cell, the resulting high electron density was also localized to the same region. Therefore, very few electrons reach a negative ion accelerator even if it is placed one or two beam diameters from such a cell. ERA

N78-32885# Los Alamos Scientific Lab., N. Mex.
LASL CONTROLLED THERMONUCLEAR RESEARCH PROGRAM Annual Progress Report, Jan. - Dec. 1976
K. S. Thomas, comp. Mar. 1978 235 p refs
(Contract W-7405-eng-36)
(LA-7082-PR) Avail: NTIS HC A11/MF A01

Topics covered include: Scyllac feedback sector experiments, staged theta-pinch program, toroidal reverse-field pinch, Scylla IV-P linear theta-pinch experiments, gun injection experiment, Scylla I-C, laser-plasma interaction studies, field reversal theta pinch, implosion heating experiment, experimental plasma physics, plasma diagnostics, high-beta Tokamak, theory, computers, engineering, magnetic energy transfer and storage, magnetic confinement systems studies, and intense neutron source facility. ERA

N78-32886# California Univ., Berkeley. Lawrence Berkeley Lab.

PRE-CUSP PHASE OF TORMAC IV AND V
M. C. Vella and B. Feinberg Apr. 1978 20 p refs
(Contract W-7405-eng-48)
(LBL-7569) Avail: NTIS HC A02/MF A01

An heuristic analysis of the pre-cusp phase of the present Tormac experiments was carried out. The immediate goal is to identify the requirements for producing a stabilized pinch in Tormac 5 qualitatively similar to that in Tormac 4. Concurrently, 5 has been modified to increase the pinch current and experimental investigation is under way. The experimental procedure is to introduce a toroidal magnetic field into the gas filled chamber. A toroidal electric field is then induced which ionizes the gas; the associated toroidal current simultaneously pinches the discharge. ERA

N78-32887# Westinghouse Electric Corp., Pittsburgh, Pa. Fusion Power Systems Dept.
STRESS ANALYSIS OF THE CONCEPTUAL DESIGN CONFIGURATIONS OF CONSTANT TENSION D-SHAPED SUPERCONDUCTING TOROIDAL FIELD COILS FOR TNS
R. Fernades and R. A. Smith 30 Sep. 1977 148 p refs
(Contract W-7405-eng-26)
(ORNL/SUB-7117/9) Avail: NTIS HC A07/MF A01

Conceptual design configurations of D-shaped toroidal field coils applicable to the TNS program are studied under the action of the toroidal field loading condition and the vertical field loading condition, but not the fault condition. Although the analysis is specific to an 8 Tesla design using a niobium titanium superconductor, the results can be extended to a coil with a different conductor material and subjected to a field of different magnitude provided the condition of linear elasticity is not violated. The analysis technique is the finite element method, with three dimensional finite elements defined in the ANSYS computer code, and supplemented by closed form analytical solutions. ERA

N78-32888# National Oceanic and Atmospheric Administration, Boulder, Colo.
ORNL FUSION POWER DEMONSTRATION STUDY: LITHIUM AS A BLANKET COOLANT
W. M. Wells Apr. 1978 39 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6214) Avail: NTIS HC A03/MF A01

The magnitude of MHD effects on flow resistance for lithium coolant is examined. Perhaps the most important consequence of this as regards use of this coolant is that of clear acceptability of such effects when the flow is predominantly transverse to the magnetic field. This permits defining a blanket that consists entirely of round tubes containing the circulated lithium with voids between the tubes. Required thermal-hydraulic calculations are then on bases which are well established. Mitigation of MHD effects is feasible through tapering of tube wall thickness or use of insulated layers, but neither scheme was mandatory for the assumed conditions. Use of boiling potassium or cesium appears to be prohibitive in terms of vapor flow area when temperature levels are consistent with the use of stainless steel. Liquid sodium, in addition to not being a breeding material, requires higher velocity than lithium for the same heat removal. Consequences of stagnant regions, which are sometimes found where flow perturbations exist, are discussed. ERA

N78-32889# Johns Hopkins Univ., Baltimore, Md.
EXTREME ULTRAVIOLET AND SOFT X-RAY DIAGNOSTICS OF HIGH-TEMPERATURE PLASMAS Annual Progress Report, 1 Jun. 1977 - 31 May 1978
H. Warren Moos, L. Armstrong, Jr., and William G. Fastie 1978 66 p refs
(Contract EY-76-S-02-2711)
(COO-2711-4) Avail: NTIS HC A04/MF A01

The Spatial Imaging Detector System is discussed; construction is complete and it is being prepared for installation on a plasma machine. EUV photometric calibration techniques at this laboratory are described. The accuracy and stability of this calibration is discussed. Theoretical calculations of relativistic transition rates and energies have continued, and studies of electron-impact ionization and excitation cross sections have begun. ERA

N78-32890# Princeton Univ., N. J. Plasma Physics Lab.
TIME EVOLUTION OF MASS FLOWS IN A COLLISIONAL TOKAMAK
Adil B. Hassam and Russell M. Kulsrud Apr. 1978 45 p refs
(Contract EY-76-C-02-3073)
(PPPL-1427) Avail: NTIS HC A03/MF A01

The time evolution, due to dissipation processes, of an initial pattern of poloidal and toroidal mass flow in a tokamak is considered. The calculation is applicable to a collision, low Beta, axisymmetric Tokamak of arbitrary minor cross section. Times rates of change of poloidal flows are given according to the magnitude of the flow and the collisionality of the plasma. Over most of parameter space for typical Tokamaks, the poloidal rotation is strongly damped by magnetic pumping. At higher speeds, even stronger damping is effected by electron thermal conduction. The toroidal rotation is determined largely by the conservation of toroidal angular momentum. A heuristic explanation of the damping due to magnetic pumping is given. ERA

N78-32891# National Oceanic and Atmospheric Administration, Boulder, Colo.
WALL STABILIZATION ACTION ON MHD INSTABILITIES
D. Berger, L. C. Bernard (General Atomic Company, San Diego, Calif.), R. Gruber (CRPP, Lausanne, Switzerland), and F. Troyon (CRPP, Lausanne, Switzerland) Apr. 1978 19 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6219) Avail: NTIS HC A02/MF A01

The effects of a perfectly conducting wall on the magnetohydrodynamic stability behavior of high beta Tokamak equilibria are presented. Toroidal wave numbers N = 0,1, and 2 are considered. For a reasonable wall-plasma distance, a range of stable operation corresponding to beta values greater than 10 percent is found. ERA

N78-32892# Utah State Univ., Logan. Dept. of Mechanical Engineering.
COIL SYSTEMS FOR MEASURING ELECTRICAL CONDUCTIVITY IN MHD COMBUSTION FLOWS Final Report
Edward W. Vendell Jan. 1978 29 p refs
(EPRI Proj. 843-1)
(EPRI-AF-569) Avail: NTIS HC A03/MF A01

An immersible two coil magnetic probe, a pneumatically actuated transversing apparatus, and provisions for gas cooling, signal conditioning and readout comprise an instrument system designed for measuring electrical resistivity in a magnetohydrodynamic combustion flow. Complexities associated with the cooling and transversing apparatus as well as funding and facility priorities contributed to unsuccessful results from a test in a seeded MHD flow and resulted in a simplification of the system. An instrument having the primary and secondary coils imbedded in an insulator wall adjacent to the conducting fluid was studied. Although not yet tested in an MHD flow, the wall-mounted coil system is attractive because coil cooling would be simplified, traversing would be unnecessary, the technique is non-intrusive, and the measurement readout would be continuous. ERA

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N78-32893 Case Western Reserve Univ., Cleveland, Ohio.
OPERATIONAL CHARACTERISTICS OF A SUPERCONDUCTING FLUX PUMP Ph.D. Thesis
Angelo Luciano Gattozzi 1978 156 p
Avail: Univ. Microfilms Order No. 7816465

A superconducting flux pump of the rotating normal spot type was studied. It is shown that the causes of non-ideal behavior are the eddy currents induced in the normal spot and the switching of the superconducting load current taking place at the leading edge of the spot. The structure of the current, magnetic field and temperature in and around the moving normal zone were derived and the resulting distributions for these field variables were used to calculate effective inductance and resistance of the spot. These parameters, functions of spot velocity, allow the

determination of an equivalent circuit for the flux pump as an electric generator. Dissert. Abstr.

N78-32894 Washington Univ., Seattle
ROLE OF DEFORMATION BENDS AND GRAIN BOUNDARIES IN FATIGUE CRACK NUCLEATION AND PROPAGATION IN SINGLE AND BICRYSTALS OF COPPER Ph.D. Thesis
Murli Saletore 1978 134 p
Avail: Univ. Microfilms Order No. 7814489

Single and bicrystals of copper with square cross-section were cycled to failure and changes in surface topography were studied using optical and scanning electron microscopy and X-ray Laue techniques. Two sets of deformation bands are shown to form on all four sides of copper single crystals of (122) axial orientation when they are subjected to low strain amplitude fatigue. The bands form prior to crack propagation and lead to the development of surface waviness. Similar sets of deformation bands are shown to develop on the surface of (122) isoaxial copper bicrystals. In the case of non-isoaxial bicrystals, deformation bands develop on the surface of the component with the (122) axial orientation and not on the surface of the (I38) component which possesses single slip characteristics. Dissert. Abstr.

N78-32895*# Texas Univ. at El Paso. Dept. of Chemistry.
ELECTRON PARAMAGNETIC RESONANCE STUDIES OF SLOWLY TUMBLING VANADYL SPIN PROBES IN NEMATIC LIQUID CRYSTALS
G. V. Bruno, J. K. Harrington, and M. P. Eastman [1978] 35 p refs
(Grant NsG-1316)
(NASA-CR-157609) Avail: NTIS HC A03/MF A01 CSCL 20B

An analysis of EPR line shapes by the method of Polnaszek, Bruno, and Freed is made for slowly tumbling vanadyl spin probes in viscous nematic liquid crystals. The use of typical vanadyl complexes as spin probes for nematic liquid crystals is shown to simplify the theoretical analysis and the subsequent interpretation. Rotational correlation times tau and orientational ordering parameters S sub Z where slow tumbling effects are expected to be observed in vanadyl EPR spectra are indicated in a plot. Analysis of the inertial effects on the probe reorientation, which are induced by slowly flucuating torque components of the local solvent structure, yield quantitative values for tau and S sub Z. The weakly ordered probe VOAA is in the slow tumbling region and displays these inertial effects throughout the nematic range of BEPC and Phase V. VOAA exhibits different reorientation behavior near the isotropic-nematic transition temperature than that displayed far below this transition temperature. L.S.

N78-32896*# National Aeronautics and Space Administration, Washington, D. C.
SILICON CRYSTALS: PROCESS FOR MANUFACTURING WAFER-LIKE SILICON CRYSTALS WITH A COLUMNAR STRUCTURE
Bernhard Authier Sep. 1978 10 p refs Transl. into ENGLISH from German Patent, Auslegeschrift 2508803, Appl. 28 Feb. 1975, (Cl. B01J17/06), 9 Sep. 1976 10 p Translation was announced as N78-21957 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Wacker-Chemitronic Ges. fuer Elektronik-Grundstoffe
(Contract NASw-3199)
(NASA-TM-75460) Avail: NTIS HC A02/MF A01 CSCL 20L

Wafer-like crystals suitable for making solar cells are formed by pouring molten Si containing suitable dopants into a mold of the desired shape and allowing it to solidify in a temperature gradient, whereby the large surface of the melt in contact with the mold is kept at less than 200 D and the free surface is kept at a temperature of 200-1000 D higher, but below the melting point of Si. The mold can also be made in the form of a slit, whereby the 2 sides of the mold are kept at different temperatures. A mold was milled in the surface of a cylindrical graphite block 200 mm in diameter. The granite block was induction heated and the bottom of the mold was cooled by means of a water-cooled Cu plate, so that the surface of the mold in contact with one of the largest surfaces of the melt was held at approximately 800 D. The free surface of the melt was subjected to thermal radiation from a graphite plate located 2 mm from the surface and heated to 1500 D. The Si crystal formed after slow cooling to room temperature had a columnar structure and was cut with a diamond saw into wafers approximately 500 mm thick. Solar cells prepared from these wafers had efficiencies of 10 to 11%. A.R.H.

N78-32897*# California Inst. of Tech., Pasadena. Seismological Lab.
POST-SHOCK TEMPERATURES IN MINERALS
Susan A. Raikes and Thomas J. Ahrens 1978 87 p refs
(Grant NGL-005-02-105)
(NASA-CR-157738) Avail: NTIS HC A05/MF A01 CSCL 20B

Post-shock temperatures were measured in a wide variety of materials, including those of geophysical interest such as silicates by using an infrared detector to determine the brightness temperature of samples shocked to pressures in the range 5 to approximately 30 GPa. Measurements were made in the 4.5 to 5.75 micron and in the 7 to 14 micron wavelength ranges. Reproducible results, withe the temperatures in the two wavelength bands generally in excellent agreement, were obtained for aluminum-2024 (10.5 to 33 GPa; 125 to 260 C), stainless steel-304 (11.5 to 50 GPa; 80 to 350 C), crystalline quartz (5.0 to 21.5 GPa; 80 to 250 C) forsterite (7.5 to 28.0 GPa; approximately 30 to 160 C) and Bamble bronzite (6.0 to 26.0 GPa; approximately 30 to 225 C). Results are generally much higher at low pressures than the values calculated assuming a hydrodynamic rheology and isentropic release parallel to the Hugoniot but tend towards them at higher pressures. A.R.H.

N78-32898*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INFERENCE OF THE RING CURRENT ION COMPOSITION BY MEANS OF CHARGE EXCHANGE DECAY
Paul H. Smith, N. K. Bewtra (Computer Sci. Corp., Silver Spring, Md.), and R. A. Hoffman Aug. 1978 41 p refs Submitted for publication
(NASA-TM-79611) Avail: NTIS HC A03/MF A01 CSCL 20L

The analysis of the measured ion fluxes during the several day storm recovery period and the assumption that beside hydrogen other ions were present and that the decays were exponential in nature, it was possible to establish three separate lifetimes for the ions. These fitted decay lifetimes are in excellent agreement with the expected charge exchange decay lifetimes for H(+), O(+), and He(+) in the energy and L-value range of the data. This inference technique, thus, establishes the presence of measurable and appreciable quantities of oxygen and helium ions as well as protons in the storm-time ring current. Indications that He(+) may also be present under these same conditions were found. L.S.

N78-32899# Nagoya Univ. (Japan). Inst. of Plasma Physics.
SCATTERING OF LATTICE SOLITONS FROM A MASS IMPURITY
Nobuo Yajima Aug. 1978 20 p refs
(IPPJ-349) Avail: NTIS HC A02/MF A01

A perturbation theory for the inverse scattering transform applies to the Toda lattice system with a mass impurity. As an example, scattering of a soliton from an impurity is considered. When the mass of impurity is slightly different from that of host particles, the soliton nearly passes through the impurity without changing its amplitude. Author

N78-32900# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Mechanical Engineering, Aeronautical Engineering and Mechanics.
TEMPERATURE DERIVATIVES OF THE FUNDAMENTAL ELASTIC CONSTANTS OF QUARTZ
B. K. Sinha and H. F. Tiersten May 1978 23 p refs
(Contract N00014-76-C-0368)
(AD-A055867; ONR-TR-25) Avail: NTIS HC A02/MF A01 CSCL 09/1

The existing temperature derivatives of the effective elastic constants of quartz are referred to the variable temperature dependent intermediate position of material points, rather than the fixed reference position, to which the fundamental elastic constants are referred. Since the existing temperature derivatives are not with respect to the fundamental elastic constants, they

cannot conveniently be employed in calculations of thermally induced frequency changes in electroded quartz resonators. This is essentially a result of the fact that a knowledge of temperature induced biasing strains and the third order elastic constants cannot be used in the existing linearly based formalism, but requires a proper nonlinearly based formalism. In order to remedy the existing situation, the derivatives with respect to temperature of the fundamental elastic constants of quartz are determined from the original data from which the existing temperature derivatives of the effective elastic constants were obtained. As usual in such work, the electric field and piezoelectric effect are completely ignored in the analytical treatment. Author (GRA)

N78-32901# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

MAGNETORESISTANCE AND HALL MEASUREMENT OF ULTRA-PURE SILICON M.S. Thesis

Robert George Schwein, Jr. Dec. 1977 71 p refs
(AD-A055640; AFIT/GEO/PH/78-1) Avail: NTIS HC A04/MF A01 CSCL 11/2

Experimental equipment was designed and built to allow automated galvanomagnetic data acquisition on semiconductor samples with resistances up to ten to the 12th power ohms. Hall and magnetoresistance data was taken on one p-type silicon sample with Boron impurity partially compensated by Phosphorus. Data was taken in a temperature range of 23 deg Kelvin to 105 Kelvin with magnetic-field strengths up to 20 Kilogauss. Magnetic-field direction was (111) and current in the sample was (110) or equivalent. Results showed that a 40 microvolt noise level in equipment amplifiers obliterated most weak-field data, and possible sample inhomogeneity caused unpredicted strong-field data trends. GRA

N78-32902# Missouri Univ. -Rolla.

MECHANISMS FOR AMORPHOUS STATE FORMATION IN ION IMPLANTED SILICON Final Report, 1 Nov. 1974 - 30 Apr. 1978

Edward B. Hale May 1978 8 p refs
(Grant DAHC04-75-G-0062)
(AD-A055480; ARO-12676.4-P) Avail: NTIS HC A02/MF A01 CSCL 20/12

A summary is given of the results obtained on this grant. Various experiments were performed to better understand the mechanisms which are important to the crystalline to amorphous transformation produced by ion implantation. From these experiments have emerged several important concepts and processes. These have been reported in several publications and talks, and it has been possible to interpret the results in terms of a composite model for the amorphization transformation. GRA

N78-32903# Pennwalt Corp., King of Prussia, Pa. Central Research and Development Dept.

PIEZOELECTRIC POLYMER TRANSDUCERS FOR DETECTION OF STRUCTURAL DEFECTS IN AIRCRAFT Final Report, 12 Jan. - 27 Apr. 1977

Phillip E. Bloomfield 22 Jul. 1977 22 p
(Contract N62269-77-M-3186; Proj. 989156)
(AD-A055729) Avail: NTIS HC A02/MF A01 CSCL 09/1

A new, versatile thin film material, PVF2 (poly-vinylidene fluoride), has been fabricated into sensors for ultrasonic transducers because of its outstanding piezoelectric properties as well as its mechanical strength and chemical stability. PVF2 has a compliance ten times higher than that found in ceramics, and its g-constant (voltage per unit stress) is very high. Since the material can be made into very thin films, very wide-band electro-acoustic transducers can be incorporated into sensors that are flexible, variable in shape and a wide range of sizes. This fabrication versatility along with its relatively low cost, and its attractive piezoelectric, mechanical strength, and chemical stability makes this material a prime candidate for a large range of applications to monitor or inspect aircraft structures. A number of inspection techniques have been explored and are discussed. These include acoustic impact testing for ball bearing wear and crack formation in metal structures; pulse-echo and transmission ultrasonics to inspect composites. Author (GRA)

N78-32904# Ballistic Research Labs., Aberdeen Proving Ground, Md.

EFFECT OF DIFFERENT INITIAL ACCELERATIONS ON THE SUBSEQUENT SHOCK PROFILE IN ONE-DIMENSIONAL LATTICES

Denis F. Strenzwilk May 1978 70 p refs
(DA Proj. 1L1-61102-AH-43)
(AD-A056365; AD-E430059; ARBRL-TR-02065) Avail: NTIS HC A04/MF A01 CSCL 20/2

Shock propagation in a one-dimensional, discrete lattice is generated by accelerating the end-most particle from zero to its final velocity in a finite rise time after which the end particle is maintained at that velocity. The wave profiles for various rise times are compared to the zero-time case in a quiescent lattice. Analytical work is presented for the linear lattice, but for the anharmonic lattice the classical equations of motion of the atoms are solved numerically on the computer. A Morse-type potential is assumed. For a finite rise time the amplitude of the wave passing through the surface atoms is diminished when compared with the zero-time case. For the anharmonic lattice the head of the wave develops into a solitary wave train with an oscillatory tail, and for certain rise times and anharmonicity parameters an envelope soliton forms behind the shock front. This envelope soliton travels much slower than the shock wave. The relevance to Army-related problems is discussed. Author (GRA)

N78-32905# National Technical Information Service, Springfield, Va.

AMORPHOUS SEMICONDUCTORS. VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1974 - Jun. 1978

Mona F. Smith Jun. 1978 157 p Supersedes NTIS/PS-77/0554; NTIS/PS-76/0372; NTIS/PS-75/368; COM-73-11705 (NTIS/PS-78/0617/7; NTIS/PS-77/0554; NTIS/PS-76/0372; NTIS/PS-75/368; COM-73-11705) Avail: NTIS HC $28.00/MF $28.00 CSCL 20L

Abstracts are presented on amorphous semiconducting thin films, chalcogenides, material fabrication, properties, and testing. Amorphous semiconductor usage in electronic devices, laser materials, ovonic switches, and memory devices are included. (This updated bibliography contains 152 abstracts, 12 of which are new entries to the previous edition.) GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N78-32906 Carnegie-Mellon Univ., Pittsburgh, Pa.

THE USE OF DISSOCIATING GASES AS THE WORKING FLUID IN THERMODYNAMIC POWER CONVERSION CYCLES Ph.D. Thesis

Krishnamurthy Kesavan 1978 274 p
Avail: Univ. Microfilms Order No. 7814383

Increasing need for more effective utilization of all available energy sources and for reduction in the capital costs of electrical power generation points to the need for developing systems with higher thermodynamic efficiencies and smaller, simpler components. The potential of steam, which is the dominant working fluid in fossil and nuclear power conversion cycles, were fully exploited. The potential of chemically dissociating substances working fluids in achieving smaller and simpler plants with improved cycle performance is explored. Results indicate that the dissociating gases can provide attractive alternatives to conventional steam and inert gases in terms of reduced electric generation costs through improved cycle efficiencies, smaller components and simpler plant arrangements. Dissert. Abstr.

N78-32907# Texas Univ., Austin. Center for Particle Theory.

INTERACTION BETWEEN CLASSICAL AND QUANTUM SYSTEMS

T. N. Sherry and E. C. G. Sudarshan Oct. 1977 65 p refs

(Contract EY-76-S-05-3992)
(ORO-3992-319) Avail: NTIS HC A04/MF A01

An unconventional approach to the measurement problem in quantum mechanics is considered. The apparatus is treated as a classical system, belonging to the macro-world. In order to have a measurement the apparatus must interact with the quantum system. The classical apparatus is embedded into a large quantum mechanical structure, making use of a superselection principle. The apparatus and system are coupled with such that the apparatus remains classical (principle of integrity), and unambiguous information of the values of a quantum observable are transferred to the variables of the apparatus. Thus interactions causing pointers to move can be added. The restrictions placed by the principle of integrity on the form of the interaction between classical and quantum systems are examined and illustration is given by means of a simple example in which one sees the principle of integrity at work. ERA

N78-32908# Texas Univ., Austin. Dept. of Physics.
APPROACH TO MEASUREMENT TO QUANTUM MECHANICS
E. C. G. Sudarshan Oct. 1977 28 p refs
(Contract EY-76-S-05-3992)
(ORO-3993-320) Avail: NTIS HC A03/MF A01

An unconventional approach to the measurement problem in quantum mechanics is considered, the apparatus is treated as a classical system, belonging to the macro-world. As a first step, the classical apparatus is embedded into a larger quantum mechanical structure, making use of superselection rules. Projection back to the classical system is possible. The apparatus and system are now coupled such that the apparatus remains classical (principle of integrity), and unambiguous information of the values of a quantum observable are transferred to the variables of the apparatus. Finally, projection back to the classical formulation is accomplished. Further measurement of the classical apparatus can be done, causing no problems of principle. Thus interactions causing pointers to move can be added. The restrictions placed by the principle of integrity on the form of the interaction between classical and quantum systems are examined. ERA

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N78-32909 Texas Univ. at Dallas.
MATERIAL REQUIREMENTS PLANNING, SCHEDULING AND INVENTORY CONTROL Ph.D. Thesis
Howard Bennett Hamilton, Jr. 1978 106 p
Avail: Univ. Microfilms Order No. 7815786

A general mathematical model of the material requirements planning problem in the manufacturing industry is formulated. An efficient system is proposed that computes near-optimal solutions of the model. The system consists of a capacity planning algorithm and a scheduling algorithm. The capacity planning algorithm aggregates the resource requirements of the independent demand items (end products and repair parts) and computes a smoothed capacity plan to meet a proposed master schedule over the planning horizon. Using several heuristic rules, the scheduling algorithm determines due dates for all components, including purchased parts and raw materials, and constructs a feasible production schedule for all products and components at low total cost. Dissert. Abstr.

N78-32910# United Technologies Research Center, East Hartford, Conn.
COMPUTERIZED PRODUCTION PROCESS PLANNING Final Technical Report, 30 Jun. 1976 - 31 Aug. 1977
Wilbur S. Mann, Mark S. Dunn, Jr., and Steven J. Pflederer Nov. 1977 191 p refs
(Contract DAAK40-76-C-1104)
(AD-A055893, UTRC/R77-942625-14) HC A09/MF A01 CSCL 05/3

A computerized production process planning system was demonstrated. The system performs generative process planning for machined cylindrical parts. Manufacturer-independence is achieved by using process decision models that express local manufacturing practice. A man-machine communications interface permits human oversight/modification of process plan development. Industry surveys were conducted to collect data relevant to the benefits of computerized process planning. Results of the surveys are summarized. Cash flow analyses estimating cost savings to industry are presented. Benefits of the demonstration system in defense procurement are projected. Author (GRA)

N78-32911# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
AIR FORCE FLIGHT DYNAMICS LABORATORY FISCAL YEAR 1979. TECHNICAL OBJECTIVE DOCUMENT
Jan. 1978 57 p Supersedes AFFDL-TR-77-33
(AD-A055711; AFFDL-TR-78-6; AFFDL-TR-77-33) Avail: NTIS HC A04/MF A01 CSCL 01/3

The document presents an overview of the Technical Planning Objectives and supporting data for each. These are extracted from the technical plan of the Air Force Flight Dynamics Laboratory (AFFDL). Information is largely based on AFFDL fiscal 1979 technology plan omitting specific funding and timing information of an 'Official Use Only' nature. Technical objectives are described for the four technical areas of: Structural Mechanics, Vehicle Equipment/Subsystems, and Flight Control and Aeromechanics. Points of contact for more information in each of the areas are identified. GRA

N78-32912# CACI, Inc. - Federal, Arlington, Va. Policy Sciences Div.
EXECUTIVE AID FOR CRISIS MANAGEMENT Final Technical Report, 1 Dec. 1976 - 30 Sep. 1977
Leo Hazelwood, Robert Mahoney, Farid Abolfaith, Janice Fain, and John Hayes 15 May 1978 68 p refs
(Contract N00014-77-C-0135; ARPA Order 2928)
(AD-A055677; CAC008) Avail: NTIS HC A04/MF A01 CSCL 05/1

This report describes the development and structure of CACI's crisis management executive aid developed for the Cybernetics Technology Office of the Defense Advanced Research Projects Agency; presents the structure of the executive aid and reviews the characteristics and uses the three data files that are available for analysis, which deal with crisis characteristics, actions and objectives, and crisis management problems; describes the data used in the aid; reviews the findings and analyses that have been performed to date on the data file; and describes procedures used to evaluate the executive aid and to transfer it to locations accessible to the U.S. Government and other users. The operation of the executive aid itself is described in detail in several separate volumes, a User's Guide, a Program Documentation Manual, a Sample Output, and a Codebook. GRA

N78-32913# National Technical Information Service, Springfield, Va.
PERT. A BIBLIOGRAPHY WITH ABSTRACTS Final Report, 1964 - May 1978
George W. Reimherr Jun. 1978 219 p Supersedes NTIS/PS-77/0519; NTIS/PS-76/0484; NTIS/PS-75/439; COM-74-10918
(NTIS/PS-78/0549/2; NTIS/PS-77/0519; NTIS/PS-76/0484; NTIS/PS-75/439; COM-74-10918) Avail: NTIS HC $28.00/MF $28.00 CSCL 05A

The use of PERT in various management areas, including military management, construction management, financial management, and many other areas are presented. Other management techniques, such as the critical path method, are included in conjunction with PERT. (This updated bibliography

contains 211 abstracts, 18 of which are new entries to the previous edition.) GRA

N78-32914# National Technical Information Service, Springfield, Va.
PERSONNEL MANAGEMENT IN REMOTE, ISOLATED, AND CONFINED AREAS. A BIBLIOGRAPHY WITH ABSTRACTS Final Report, 1964 - Jun. 1978
Carolyn Shonyo Jun. 1978 45 p Supersedes NTIS/PS-77/0553; NTIS/PS-76/0449
(NTIS/PS-78/0595/5; NTIS/PS-77/0553; NTIS/PS-76/0449) Avail: NTIS HC $28.00/MF $28.00 CSCL 05I

Annotated references are cited concerning behavior in remote, isolated, and confined environments, with specific application to personnel management in these areas. Antarctic work areas and submarine environments are included. The topics covered include personnel selection, performance evaluation, group dynamics, social communication, social isolation, psychological aspects, and personality factors. (This updated bibliography contains 40 abstracts, none of which are new entries to the previous edition.) GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N78-32915 Southern Illinois Univ. at Carbondale.
AN AXIOMATIC TREATMENT OF INFORMATION STORAGE AND RETRIEVAL IN SYSTEMS Ph.D. Thesis
Kristin Freya Thulin Kocan 1976 172 p
Avail: Univ. Microfilms Order No. 7813555

Attempts are made to relate the concepts of information theory to time semi-system theory. Such concepts include information storage capacity, coding, redundancy, and reliability. In particular, system redundancy is quantified, and a reliability function is defined such that it is an objective system parameter. These achievements allow for optimization of redundancy or reliability. Attempts are also made to derive criteria for the existence of specific proposed mechanisms for memory in living organisms. In order to fulfill this purpose, time semi-system theory is related to a type of biological system, the central nervous system. This approach yields logical implications concerning proposed memory mechanisms. These implications are derived from experimental data using the framework of time semi-system theory. Dissert. Abstr.

N78-32916 American Univ., Washington, D. C.
PROJECTIONS OF INFORMATION-TECHNOLOGY EMPLOYMENT TO THE YEAR 2000 Ph.D. Thesis
Lionel Fernandez 1978 226 p
Avail: Univ. Microfilms Order No. 78-06919

The growing importance of information technology jobs in the civilian employed labor force and the magnitude of information technology occupations in the future was investigated. The methological approach involved development of data tracing the employment of information technology workers since 1900. Employment projections were constructed to 1985 and 2000 to track the growth and increasing importance of information technology jobs in the U.S. economy. These data were compared with estimates from a socio-economic maturation model for 1972 and 2000. An employment series for the 1970 to 2000 period was developed. The findings indicate that information technology workers accounted for 11 percent of the civilian employed labor force in 1900, and between 22 percent to 40 percent in 1970. By 1985, this proportion will range from 26 percent to 49 percent and by 2000, information technology employment will account for as much as 66 percent of the civilian employed labor force. Dissert. Abstr.

N78-32917*+ National Aeronautics and Space Administration, Washington, D. C.
NASA PATENT ABSTRACTS BIBLIOGRAPHY: A CONTINUING BIBLIOGRAPHY. SECTION 1: ABSTRACTS
Jul. 1978 65 p refs
(NASA-SP-7039(13)-Section-1) Avail: NTIS HC E04 CSCL 05B

This bibliography is issued in two sections: Section 1 - Abstracts, and Section 2 - Indexes. This issue of the Abstract Section cites 161 patents and applications for patent introduced into the NASA scientific and technical information system during the period January 1978 through June 1978. Each entry consists of a citation, an abstract, and in most cases, a key illustration selected from the patent or application for patent. Author

N78-32918*+ National Aeronautics and Space Administration, Washington, D. C.
NASA PATENT ABSTRACTS BIBLIOGRAPHY: A CONTINUING BIBLIOGRAPHY. SECTION 2: INDEXES
Jul. 1978 586 p refs
(NASA-SP-7039(13)-Section-2) Avail: NTIS HC E06 CSCL 05B

This issue of the Index Section contains entries for 3386 patent and application for patent citations covering the period May 1969 through June 1978. The Index Section contains five indexes --- subject, inventor, source, number, and accession number. Author

N78-32919# Syracuse Univ., N. Y.
LARGE SCALE INFORMATION SYSTEMS, VOLUME 2 Final Technical Report, 3 Jun. 1974 - 2 Feb. 1977
Griffiss AFB, N. Y. RADC Mar. 1978 201 p refs 4 Vol.
(Contract F30602-74-C-0335)
(AD-A054943; RADC-TR-78-43-Vol-2) Avail: NTIS HC A10/MF A01 CSCL 09/2

This report describes and references work conducted by Syracuse University in four broad areas: parallel processing, programming languages, modeling, and performance evaluation of generalized data management systems. A number of applications were evaluated for processing by an associative processor architecture including air traffic control, carryless arithmetic, and simulation of high-speed random logic. An extension of the typed lambda calculus has been developed which permits the binding and application of types. User-defined types and procedural data structures are shown to be complementary tools for data abstraction. Direct and continuation semantics of the domain of flow diagrams are formulated and the properties explored. The use of transition diagrams as a tool for structured programming has been investigated. A variety of concepts and notations have been devised to facilitate reasoning about arrays. Work relation to various simulation tasks are reported on. A tutorail on the current statistical methods of analyzing simulation output data is provided. A number of tasks relating to file systems are discussed and a framework is advanced for describing various file organizations and operations on files. Author (GRA)

N78-32920# Syracuse Univ., N. Y.
LARGE SCALE INFORMATION SYSTEMS, VOLUME 4 Final Technical Report, 3 Jun. 1974 - 2 Feb. 1977
Griffiss AFB, N. Y. RADC Mar. 1978 38 p refs 4 Vol.
(Contract F30602-74-C-0335)
(AD-A054945; RADC-TR-78-43-Vol-4) Avail: NTIS HC A03/MF A01 CSCL 09/2
For abstract, see N78-32919.

N78-32921# Colorado State Univ., Fort Collins. Dept. of Electrical Engineering.
MODULO-2 pi PHASE SEQUENCE ESTIMATION
Louis L. Scharf, Dennis D. Cox, and C. Johan Masreliez Feb. 1978 66 p refs
(Contract N00014-75-C-0518)
(AD-A055924; TR-27(ONR)) Avail: NTIS HC A04/MF A01 CSCL 09/4

The probabilistic evolution of random walk on the circle is studied and the results used to derive a MAP sequence estimator for phase. The sequence estimator is a Viterbi tracker for tracking phase on a finite-dimensional grid in (-Pi, Pi). The algorithm is shown to provide a convenient method for obtaining fixed-lag phase sequence estimates. Performance characteristics are presented and compared with several other nonlinear filtering

algorithms. The results indicate superior performance over the range of parameter values usually considered and excellent performance in parameter ranges corresponding to high signal-to-noise ratio and rapidly fluctuating phase. Applications to coherent data communication systems are outlined. Author (GRA)

N78-32922# Defense Documentation Center, Alexandria, Va.
DEFENSE DOCUMENTATION CENTER REFERRAL DATA BANK DIRECTORY, EDITION NO. 7
Alice L. Cox Jun. 1978 421 p Supersedes DDC/TR-76/5 (AD-A055700; DDC/TR-78/2; DDC/TR-76/5) Avail: NTIS HC A18/MF A01 CSCL 05/2

This revised directory of the information sources in the DDC Referral Data Bank consists of a compilation of computer printouts, each of which gives, for a single activity, detailed descriptive information on the mission, scope and services provided. Arrangement is numerical by referral number and alphabetical by activity name, with two indexes: director/contact and subject. A list of Department of Defense Information Analysis Centers with military sponsor(s), is given. GRA

N78-32923# Syracuse Univ., N. Y.
LARGE SCALE INFORMATION SYSTEMS, VOLUME 3 Final Technical Report, 3 Jun. 1974 - 2 Feb. 1977
Griffiss AFB, N. Y. RADC Mar. 1978 381 p refs 4 Vol. (Contract F30602-74-C-0335)
(AD-A054944; RADC-TR-78-43-Vol-3) Avail: NTIS HC A17/MF A01 CSCL 09/2

For abstract, see N78-32919.

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N78-32924 California Inst. of Tech., Pasadena.
TWO ESSAYS ON THE ECONOMICS OF ELECTRICITY SUPPLY. 1: HAS THE AVERCH-JOHNSON EFFECT BEEN EMPIRICALLY VERIFIED? 2: ELECTRICITY PRICING Ph.D. Thesis
Derek John McKay 1978 157 p
Avail: Univ. Microfilms Order No. 78-05695

Investigations in two areas of the economics of electricity supply are reported. The first chapter examines empirical evidence to determine whether rate of return regulation has produced detectable overcapitalisation in this industry. The second chapter studies the determination of optimal pricing mechanisms for electricity, particularly in the presence of uncertainty. Dissert. Abstr.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N78-32925 Wisconsin Univ. - Madison.
THE COMMUNICATIONS SATELLITE ACT OF 1962: THE CREATION OF A NEW COMMUNICATIONS POLICY Ph.D. Thesis
William Eyre Lee 1977 299 p
Avail: Univ. Microfilms Order No. 78-00031

Presidential goals as regards communications satellites and foreign policy are cited as influential factors in the formation of the novel corporation-Comsat. It is shown that government regulation and innovation policy have realized rapid development of a global satellite system free from carrier domination enabling the corporation to act as a component of American foreign policy. Dissert. Abstr.

N78-32926# Committee on Science and Technology (U. S. House).
NASA AUTHORIZATION, 1979, VOLUME 1, PART 3
Washington GPO 1978 2091 p refs Hearings on H.R. 10664 (superseded by H.R. 11401) before Subcomm. on Space Sci. and Applications of the Comm. on Sci. and Technol., 95th Congr., 2d Sess., 8-9; 22-23 Feb. 1978
(GPO-25-291) Avail: Subcomm. on Space Sci. and Applications

Testimony given in response to direct questions and statements delivered in support of NASA budget requests are presented. Topics cover NASA OE cooperation in the development of energy technology with emphasis on the satellite solar power satellite program, space shuttle status and applications, satellite communication systems, NASA in-house management matters, and the agency's operating plan. A.R.H.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N78-32927# National Technical Information Service, Springfield, Va.
DUAL MODE TRANSPORTATION. A BIBLIOGRAPHY WITH ABSTRACTS Final Report, 1964 - May 1978
Edith Kenton Jun. 1978 169 p Supersedes NTIS/PS-77/0490; NTIS/PS-76/0352; NTIS/PS-75-287
(NTIS/PS-78/0538/5; NTIS/PS-77/0490; NTIS/PS-76/0352; NTIS/PS-75/287) Avail: NTIS HC$28.00/MF $28.00 CSCL 13B

The discussions of personal rapid transit systems, inter-city networks, rapid transit railways, buses, automobile travel, and automated guideways are cited. References are made to communication requirements, worst case analysis, freeway transit, dial-a-ride, airport access, and socioeconomic factors. Materials are included on modal split and multimodal systems. (This updated bibliography contains 163 abstracts, 9 of which are new entries to the previous edition.) GRA

N78-32928# Transportation Research Board, Washington, D. C.
PREDICTING AND MEASURING IMPACTS OF TRANSPORTATION SYSTEMS
Hays B. Gamble, Lawrence C. Lavery, Darwin G. Stuart, H. Theresa Coulter, and Rolf R. Schmitt 1977 46 p refs
(PB-280281/7; TRB/TRR-634) Avail: NTIS HC A03/MF A01 CSCL 13B

Contents: Impact of transporation-facility deterioration and abandonment; automobile-restricted zones; analyzing indirect impacts of alternative automated-guideway-transit systems; comparison of the usefulness of two multiregional economic models in evaluating transportation policies; predicting the impacts of transportation on the spread of urban blight; insights into the practice of joint development--lessons from experience; impact of railroad abandonment on rural highways. GRA

N78-32929# Envirex, Inc., Milwaukee, Wis. Environmental Sciences Div.
HANDLING AND DISPOSAL OF SLUDGES FROM COMBINED SEWER OVERFLOW TREATMENT. PHASE 1: IMPACT ASSESSMENT Final Report, Feb. 1974 - 1978
Kathryn R. Huibregtse, Gary R. Morris, Anthony Geinopolos, and Michael J. Clark Dec. 1977 212 p refs
(Contract EPA-68-03-0242)
(PB-280309/6; EPA-600/2-77-053b) Avail: NTIS HC A10/MF A01 CSCL 13B

The results of an assessment of the effort that the United States will have to exert in the area of sludge handling and disposal if, in fact, full-scale treatment of combined sewer overflows is to become a reality is documented. The results indicate that nationwide an average yearly sludge volume of 156,000,000 cu m (41.5 x 10 to the 9th power gal.) could be expected from CSO if complete CSO treatment were achieved.

Evaluation of the effect of bleed/pump-back of CSO sludge on the hydraulic, solids and/or organic loadings to the dry-weather plant indicated that overloading would occur in most instances. The most promising treatment trains were found to include possible grit removal, lime stabilization, optical gravity thickening, optional dewatering and land application or landfill. Land application systems can be considered as viable alternative for CSO treatment and disposal. Estimates are indicated for the first investment capital costs. Author

N78-32930# Public Technology, Inc., Washington, D. C.
LAND MANAGEMENT. A MANAGEMENT REPORT FOR STATE AND LOCAL GOVERNMENTS
1977 31 p 4 Vol.
(Grant NSF ISP-76-84564)
(PB-281313/7; NSF/RA-770450) Avail: NTIS
HC A03/MF A01; also available in set of 4 reports HC E09, PB-281312-SET CSCL 13B

Three sequential functions in the land management process are planning, implementing and monitoring. The planning function includes defining critical land management issues; formulating goals and objectives; developing plans and programs to meet these objectives; and adopting budgets, policies, standards, regulations, and procedures. The implementing function includes determining the appropriate level of review for land use or development proposal assessing their consequences, and approving or rejecting the proposals. The monitoring function includes inspecting projects; correcting deviations from land management codes, standards, regulations, and agreement; and evaluating the effectiveness of land management objectives, plans, programs, policies, and procedures. GRA

N78-32931# Public Technology, Inc., Washington, D. C.
LAND MANAGEMENT. SELECTED PARTICIPATORY TECHNIQUES FOR STATE AND LOCAL GOVERNMENTS
1977 64 p refs 4 Vol.
(Grant NSF ISP-76-84564)
(PB-281314/5; NSF/RA-770451) Avail: NTIS
HC A04/MF A01 CSCL 13B

Techniques augment existing opportunities that the community, elected officials, and government staff can use in the land management process including: (1) public involvement programs that establish a framework for managing community participation as a process; (2) mass media to prepare the public for active participation through education, information dissemination, and notification of participatory activities; (3) games to broaden the perspectives of game players; (4) community workshops to enable the community and elected officials to more actively participate in land management planning; (5) nominal group and Delphi processes structure group interactions; and (6) surveys to provide more accurate feedback on public perceptions, desires, needs, preferences, priorities, opinions, and experiences. GRA

N78-32932# Public Technology, Inc., Washington, D. C.
LAND MANAGEMENT. SELECTED ANALYTICAL TECHNIQUES FOR STATE AND LOCAL GOVERNMENTS
1977 100 p refs 4 Vol.
(Grant NSF ISP-76-84564)
(PB-281315/2; NSF/RA-770452) Avail: NTIS
HC A05/MF A01; also available in set of 4 reports HC E09, PB-281312-SET CSCL 13B

Potential impacts of land use or development decisions on communities and their environments may be determined from impact measures; assessment matrices; cause-condition-effect network; data collection, analysis and evaluations; cost-revenue analysis; program evaluation and analysis; and standards to be used as benchmarks against which to make comparisons. GRA

N78-32933# Public Technology, Inc., Washington, D. C.
LAND MANAGEMENT. CONTROLS AND INCENTIVES FOR USE BY STATE AND LOCAL GOVERNMENTS
1977 158 p refs 4 Vol.
(Grant NSF ISP-76-84564)
(PB-281316/0; NSF/RA-770453) Avail: NTIS
HC A08/MF A01; also available in set of 4 reports HC E09, PB-281312-SET CSCL 13B

Sixty-eight implementation techniques written for land management programs are evaluated. The controls and incentives included are: (1) policy and assessment tools to provide government with a framework for evaluating land use and development proposals against established standards; (2) regulatory mechanisms to provide direct control over land use and development; (3) capital expenditures for stimulating private development and controlling land use patterns; and (4) revenue mechanisms which indirectly influence land use and development in the form of property taxes, special taxes and fees, and exactions. GRA

N78-32934# Agricultural Research Services, Beltsville, Md. Biological Waste Management and Soil Nitrogen Lab.
SEWAGE SLUDGE ENTRENCHMENT SYSTEM FOR USE BY SMALL MUNICIPALITIES Interim Report, Jun. 1974 - Jun. 1975
J. M. Walker, L. Ely, P. Hundemann, N. Frankos, and A. Kaminski Feb. 1978 83 p refs
(PB-280662/8; EPA-600/2-78-018) Avail: NTIS
HC A05/MF A01 CSCL 13B

A method of disposing of dewatered sewage sludge by entrenching it into soil was developed for small communities. Readily available and relatively inexpensive equipment was used. Included were a tractor equipped with a loader and backhoe, and dump truck or concrete mixer truck. The time required to entrench 12 tons of dewatered sludge was one hour. The estimated cost of sludge incorporation was less than $15.00 per ton of dewatered sludge. Reuse of a previously trenched site indicate that about 2 years is the minimum satisfactory time lapse between the first and second entrenchment. GRA

N78-32935# Gulf South Research Inst., New Orleans, La.
CHARACTERIZATION OF REUSABLE MUNICIPAL WASTEWATER EFFLUENTS AND CONCENTRATION OF ORGANIC CONSTITUENTS Final Report, Jun. 1974 - Mar. 1977
James K. Smith, A. J. Englande, Mary M. McKown, and Stephen C. Lynch Feb. 1978 143 p refs
(Contract EPA-68-03-2090)
(PB-280547/1; EPA-600/2-78-016) Avail: NTIS
HC A07/MF A01 CSCL 13B

Organic concentrates were collected from operating advanced wastewater treatment (AWT) plants for use in health effects testing. In addition, chemical, physical, and biological analyses of effluents from the six AWT systems were conducted to determine how the quality of the effluents from these systems compared with current drinking water regulations. In spite of the fact that the AWT systems were not designed to produce potable water, all were characterized by high quality effluents. These systems were selected primarily because of availability and because effluent quality exceeded that of secondary treatment systems. Spot samples taken over a six to nine month period indicated that the parameters found to exceed drinking water regulations in most of the treated effluents included nitrogen (ammonia and nitrate), phenol, odor, carbon chloroform extract, turbidity, and specific heavy metals. Author

N78-32936# Envirex, Inc., Milwaukee, Wis. Environmental Sciences Div.
HANDLING AND DISPOSAL OF SLUDGES FROM COMBINED SEWER OVERFLOW TREATMENT. PHASE 3: TREATABILITY STUDIES Final Report, Jul. 1975 - May 1977
R. Osantowski, A. Beinopolos, R. E. Wullschleger, and M. J. Clark Dec. 1977 274 p refs
(Contract EPA-68-03-0242)
(PB-281006/7; EPA-600/2-77-053) Avail: NTIS
HC A12/MF A01 CSCL 13B

The results of a project initiated to evaluate the handling and disposal of combined sewer overflow (CSO) treatment residuals are documented. Bench scale thickening and pilot and full-scale centrifugation dewatering tests were performed at dry-weather and CSO treatment sites in Kenosha, Racine, and Milwaukee, Wi. In addition, bench scale anaerobic digestion studies were conducted to determine the effect of CSO sludges on the anaerobic digestion stabilization process. The results indicated that the dewatering of CSO sludges appears feasible when the sludges are first degritted, where required, and thickened prior to centrifugation. Preliminary economic estimates indicate that

first investment capital costs for thickening-centrifiguation of CSO sludges ranged from 0.31 to 2.92 million dollars with annual costs of $49,500 to $659,300 per year when handling 4.0 to 36.5 tons dry sludge per day, respectively. Author

N78-32937# Planning Research Corp., McLean, Va.
INTERMODAL MANAGEMENT INFORMATION SYSTEM. PHASE 2: STATE-OF-THE-ART-SURVEY Final Report
J. Peternick, V. Frederickson, A. Pflugrad, B. Rynders, R. Wiersema, G. Sargent (Ford, Bacon and Davis, Inc.), S. Kendrick (Ford, Bacon and Davis, Inc.), R. Short (Norfolk and Western Railway Co.), R. Holland (Norfolk and Western Railway Co.), and J. Robertson (Norfolk and Western Railway Co.) Mar. 1978 171 p refs
(Contract DOT-FR-741-5157)
(PB-281016/6; FRA/OPPD-78/8) Avail: NTIS HC A08/MF A01 CSCL 13F

Survey objectives were to determine the state of existing and planned systems which support any or all aspects of intermodal activity, and to identify unmet needs. A sample of eight railroads was surveyed. In addition, one common carrier, two trucking subsidiaries, and one international water carrier were included to further diversify the investigation of intermodal activities. Findings of the survey were verified by a search of pertinent literature and related research. Survey participants indicated that increased capabilities are needed in the following areas: an intermodal equipment control system; a repetitive waybilling and rating system; and a profit analysis system. GRA

N78-32938# Garretson, Elmendorf, Zinov, and Rebbin, San Francisco, Calif.
HAZARDOUS WASTE MANAGEMENT: PROBLEM ASSESSMENT AND STRATEGY FORMULATION
Apr. 1978 296 p refs Sponsored in part by Hawaii State Dept. of Health, Honolulu
(Grant EPA-L-009104-1)
(PB-281153/7) Avail: NTIS HC A13/MF A01 CSCL 13B

Hazardous waste management in the State of Hawaii, Territory of Guam, Government of Northern Marianas, and the Trust Territory Islands of the Pacific is discussed. The types, quantities, and generators of hazardous waste are identified. Future solid waste generation assesses the adequacy of present management practices, and alternatives for future management are projected. Author

N78-32939# Informatics, Inc., Rockville, Md.
FEDERAL LABORATORY CONSORTIUM FOR TECHNOLOGY TRANSFER OPERATIONS AND REFERENCE GUIDE: FIRST EDITION JUNE 1977
Jun. 1977 146 p refs Prepared for NSF Sponsored in part by Federal Lab. Consortium
(PB-281677/5; NSF/RA-770113) Avail: NTIS HC A07/MF A01 CSCL 14B

The Federal Laboratory Consortium for Technology Transfer consists of about 150 of the largest Federal government laboratories and centers from high technology areas. Its purpose is to increase the use of these laboratories' technical expertise and R & D products toward the solution of problems facing government agencies and private industries. This guide was prepared to provide user organizations with information on the resource capabilities readily available from the Consortium member laboratories. It describes the Federal Laboratory Consortium and describes the technology transfer process. It identifies many of the organizations which cooperate with the Consortium on technology transfer activities on a national, regional, or state-wide basis; and it contains a set of Federal laboratory profiles which summarize the resources and capabilities of the individual laboratories. GRA

N78-32940# Federal Lab. Consortium, Washington, D. C.
FEDERAL LABORATORY CONSORTIUM RESOURCE DIRECTORY
Dec. 1977 300 p refs Sponsored by NSF
(PB-281678/3; NSF/RA-770474) Avail: NTIS HC A13/MF A01 CSCL 14B

A selection was prepared of Federal laboratory scientific and technological activities, representing facilities with a selection of typical technology transfer efforts. The directory involves a map indicating the various regions of the FLC, an alphabetical listing of the member laboratories, a list of participating laboratories/contacts by geographic region, and a list of the CONTAC (Contacts for Technological Area Coordination) laboratories. A rundown is given of the major application areas and those laboratories with expertise in these areas, followed by information sheets for each laboratory indicating specific scientific and technological areas of expertise along with the contact person for that facility. Examples are provided of laboratory technology transfer projects in the majority of the scientific and technological activities. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N78-32941 California Univ., Berkeley.
OBSERVATIONS OF THE 18 MICRON FINE-STRUCTURE LINE S III IN IONIZED NEBULAE Ph.D. Thesis
Lawrence Thomas Greenberg 1977 101 p
Avail: Univ. Microfilms Order No. 7812581

The fine-structure line due to the P2-3 - P1-3 transition in the ground term of doubly ionized sulfur was detected in emission from three ionized nebulae: NGC7027, BD+30 degree 3639 and G333.6-0.2. The observed wavelength lambda = 18.70 microns, determines an accurate value for the fine-structure splitting of 534.42 + or - 0.03/cm. These observations are the first obtained with a new spectrometer designed for operation in the 20 micron atmospheric transmission window. Searches for S 3 emission in several other objects are described as well as some preliminary observations of other spectral features of astrophysical interest that lie in the 20 micron atmospheric window. Dissert. Abstr.

N78-32942 California Univ., Berkeley.
AN INFRARED UPCONVERTER FOR ASTRONOMICAL IMAGING Ph.D. Thesis
Robert William Boyd 1977 91 p
Avail: Univ. Microfilms Order No. 7812503

An imaging upconverter was constructed which is suitable for use in the study of the thermal 10 micrometers radiation from astronomical sources. The infrared radiation is converted to visible radiation by mixing in a one centimeter long proustite crystal with a 0.20 watt, 0.7525 micrometers krypton ion laser beam. In order to provide a large usable field of view, several hundred spatial modes of the infrared field are simultaneously upconverted. This instrument was used at the 150 cm McMath solar telescope of Kitt Peak National Observatory to study the Sun, Moon, Mercury, and the star VY Canis Majoris. The field of view of 40 arc seconds on the sky contained several hundred picture elements, approximating diffraction-limited resolution for this telescope. The deleterious effects of atmospheric inhomogeneities on telescope angular resolution were studied in the infrared region using this apparatus. Seeing was found to be systemically better at 10 micrometers than in the visible, in good agreement with theoretical predictions. Dissert. Abstr.

N78-32943 Arizona Univ., Tucson.
ASTRONOMICAL IMAGING POLARIMETRY Ph.D. Thesis
Gary Dean Schmidt 1978 170 p
Avail: Univ. Microfilms Order No. 7813900

The technique of astronomical imaging polarimetry is developed. The various polarization analyzers and multielement detector options available are evaluated in regard to their potential accuracy, efficiency, field of view, and resolution. The photographic technique was used to map the surface brightness and polarization

of the galaxy M82. These maps reveal that the majority of the halo light can be assigned to a smooth component which is symmetric about the galactic disk, and only a small fraction to filamentary structure. The halo radiation is scattered light which originates primarily in the galactic disk and not a bright nucleus. A rapidly-chopping photoelectric imaging polarimeter was constructed using a Pockels cell modulator and 200 electron Digicon detector. This instrument was used to obtain accurate, high resolution maps of optical polarization and surface brightness in the bipolar nebulae CRL 2688 and MI-92, the jets of M87 and 3C 273, and the Crab Nebula. Dissert. Abstr.

N78-32944 California Univ., San Diego.
DENSITY SPECTRUM AND VELOCITY OF THE SOLAR WIND INFERRED FROM SCINTILLATION OBSERVATIONS Ph.D. Thesis
Stephen Lynn Scott 1978 203 p
Avail: Univ. Microfilms Order No. 7813153

Intensity scintillation observations covering the frequency range of 270 to 8085 MHz are analyzed to extract information about the solar wind. The data cover distances from the sun of approximately 5 to 100 solar radii. The data were taken in two separate experiments. The first considered involves single site multifrequency observations at three frequencies from 270 to 470 MHz taken in 1976. The second experiment is comprised of three site spaced receiver observations at 2295 MHz and single site observations at 1410 and 8085 MHz. The data were analyzed in order to: (1) infer the shape of the electron density spectrum; (2) estimate the solar wind velocity and random velocity near the sun; (3) develop and test a method of single site velocity determination; and (4) compare weak scattering theory and experiment. Dissert. Abstr.

N78-32945*# Colorado Univ., Boulder.
A STUDY OF MASS FLOW IN THE MASSIVE SPECTROSCOPIC BINARY HD47129 Final Technical Report, 1 Jan. - 31 Dec. 1977
M. J. Barlow (Anglo-Australian Obs.) and P. S. Conti 1978 4 p Submitted for publication
(Grant NsG-5147)
(NASA-CR-157613) Avail: NTIS HC A02/MF A01 CSCL 03A

HD 47129 is a double-lined spectroscopic binary with a period 14.3961 days and a visual magnitude of V = 6.06. Using the Copernicus U2 spectrometer, observations were obtained of the system on eight occasions, starting March 2, 1977. Some results are presented and discussed. G.Y.

N78-32946*# Ohio State Univ., Columbus. Research Foundation.
THE OBSERVABILITY OF THE CELESTIAL POLE AND ITS NUTATIONS
Alfred Leick Jun. 1978 103 p refs
(Grant NsG-5265; OSURF Proj. 711055)
(NASA-CR-157606; OSU-262) Avail: NTIS HC A06/MF A01 CSCL 03A

The expected motion characteristics of the real earth are systematically analysed based on available dynamical theories for the rigid model, the elastic earth model and the earth model with liquid core. The various axes which are implicit in the dynamical theories are investigated regarding observability on the basis of astronomical observations and suitability for defining reference directions. The observational insignificance of the "diurnal polar motion" is demonstrated. A special effort is made to clarify customarily used terminology. Author

N78-32947*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
OPTIMIZING INDIUM ANTIMONIDE (InSb) DETECTORS FOR LOW BACKGROUND OPERATION
Richard R. Treffers Sep. 1978 18 p refs
(NCA2-OR050-606)
(NASA-TM-73273; A-7149) Avail: NTIS HC A02/MF A01 CSCL 03A

The various noise sources that affect InSb detectors (and similar voltaic devices) are discussed and calculated. Methods are given for measuring detector resistance, photon loading, detector and amplifier capacitance, amplifier frequency response, amplifier noise, and quantum efficiency. A photovoltaic InSb detector with increased sensitivity in the 1 to 5.6 mu region is dicussed. A.R.H.

N78-32948*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE SIGNIFICANCE OF GAMMA RAY OBSERVATIONS FOR NEUTRINO ASTRONOMY
Carl E. Fichtel Sep. 1978 25 p refs Presented at DUMAND (Deep Underwater Muon and Neutrino Detector) Workshop on High Energy Neutrino Astronomy, La Jolla, Calif., 7-20 Aug. 1978 Submitted for publication
(NASA-TM-79640) Avail: NTIS HC A02/MF A01 CSCL 03A

Celestial gamma-rays and neutrinos are formed in some of the same astrophysical interactions, but have important different properties. Measurements of these radiations were used to study the presence and dynamic effects of energetic charged cosmic ray particles, element synthesis and particle acceleration. In addition, since gamma-rays in the energy range from several MeV to at least 10 to the 12th power eV and neutrinos both have very low interaction cross sections, they have a very high penetrating power and reach the earth from almost any part of the galaxy or universe. Therefore, they retain the detailed imprint of spectral, directional and temporal features imposed at their birth, even if they were born in regions opaque to visible light and X-rays. G.G.

N78-32120# Indian Space Research Organization, Bangalore. Satellite Center.
X-RAY ASTRONOMY
T. M. K. Marar *In* Indian Inst. of Sci. Space Sci., Technol. and Appl.: An Overview Apr. 1978 8 p refs (For primary document see N78-32114 23-12)
Avail: NTIS HC A10/MF A01

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N78-32949 Arizona Univ., Tucson.
THE ABSORPTION LINE SPECTRA OF HIGH REDSHIFT QSOs Ph.D. Thesis
Gary Dean Coleman 1978 166 p
Avail: Univ. Microfilms Order No. 7812921

Moderate resolution spectroscopy was obtained for a sample of three high redshift QSOs, 4C05.34, OH 471, and OQ 172. All material for each object used to produce a composite spectrum, and a Gaussian line profile fitting routine was used to measure the positions and equivalent widths of absorption lines in the composite spectra. Standard line identification techniques were applied, and Monte Carlo simulations were performed to evaluate the statistical significance of the candidate redshift systems. This approach was fairly successful for 4C05.34, where 11 absorption systems were found which are unlikely to have been produced by chance coincidence. The redshift system at z = 2.475 contains very strong O VI lines and excited fine-structure (EFS) lines of C II and Si II, and is quite likely to be intrinsic to the QSO. The redshift system at z = 2.875 also contains extremely strong O VI lines, and the intensity ratios of the O VI doublet and of L alpha and L beta suggest that the absorption arises in a filament or cloud within the emission region. The redshift system indentification procedure was much less successful for both OH 471 and OQ 172. Dissert. Abstr.

N78-32950 California Univ., Irvine.
COHERENT CURVATURE RADIATION AND ITS APPLICATION TO ASTROPHYSICAL PHENOMENA Ph.D. Thesis
Robert G. Buschauer 1978 200 p
Avail: Univ. Microfilms Order No. 7811857

A general formalism is developed for coherent emissions by a relativistic plasma whose particles move along adjacent curved trajectories. The plasma is rippled by a plane wave of wavenumber k sub o and coherence length s sub o which causes charge bunching. These phase correlated particles then emit coherently over a band of frequencies. The theory displays many features.

For example, the transverse dimensions of the plasma and the phase velocity of the wave in the plasma frame dramatically effect the spectral and angular emission characteristics. The new formalism is applied to the radio emission from pulsars. An important error is pointed out in the Ruderman-Sutherland calculation of a growth rate and its consequences are discussed. An expression is derived for the total angular and spectral radio emission for the pulsar by adding the contributions of bunched beam-plasma columns traveling in various directions in the complicated dipolar geometry. Dissert. Abstr.

N78-32951 California Univ., Santa Cruz.
GALACTIC WINDS AND THE HUBBLE SEQUENCE Ph.D. Thesis
Joel Norman Bregman 1977 53 p
Avail: Univ. Microfilms Order No. 7811550

The conditions for maintenance of supernova-driven winds was investigated to assess their role in the morphology of disk-bulge galaxies. A fluid mechanical model with gas and stars and which includes galactic rotation was used to investigate several classes of winds. It is found that many galaxies, once their initial gas is depleted, can maintain a wind throughout the entire galaxy, a condition most easily satisfied by systems with a small bulge-to-disk ratio. If the ratio of supernova heating to total mass falls below a critical value that depends on galaxy type and mass, only a partial wind exterior to a critical surface can exist, with infall occurring at interior points. Galaxies in which only the bulge is depleted of gas may support a bulge wind that does not interact with the colder and denser gas in the disk. Dissert. Abstr.

N78-32952 Iowa State Univ. of Science and Technology, Ames.
SPECTRAL CONTAMINATION IN BINARY X-RAY SYSTEMS: GAS FLOW EFFECTS ON MASS DETERMINATIONS Ph.D. Thesis
Mark Aldrich Moulding 1978 191 p
Avail: Univ. Microfilms Order No. 7813239

Possible spectral contamination by emission lines from accreting gas is studied for its influence on the mass determination of the compact X-ray source Cygnus X-1. Described are emission lines each of whose distortion of the primary H beta absorption line would lead to overestimation of the system mass function, artificially placing the inferred mass of the compact component above the stable neutron star mass range. The large set of such lines was found to contain lines likely to arise in emission regions in the Cygnus X-1 system. It seems probable that application of this analysis to other lines, orbital phases, and X-ray sources would support the thesis that such subtle distortion may significantly affect the interpretation of radial velocity curves for this and similar systems. Some possible observational tests of this theory are also outlined.
Dissert. Abstr.

N78-32953 Maryland Univ., College Park.
A STUDY OF A TECHNIQUE OF PENCIL BEAM SYNTHESIS WITH A LINE APERTURE AND ITS USE IN MAPPING GIANT RADIO GALAXIES Ph.D. Thesis
Richard Alan Perley 1977 292 p
Avail: Univ. Microfilms Order No. 7814014

A method of two-dimensional image formation is analyzed and utilized to map the radio emission from four large radio galaxies. These sources were: (1) the cluster of galaxies Abell 426 which contains the radio-bright Seyfert galaxy 3C84 and the head-tail radio galaxy 3C83.1B, (2) the giant dumbbell radio galaxy DA240, (3) the giant dumbbell radio galaxy 3C236, and (4) the large head-tail radio galaxy 3C129. The techniques of observation and map reconstruction are discussed in detail, and the relation between this technique and earth-rotation aperture synthesis is shown. The limitations of the technique due to the effects of the fixed antennas and the incremental phasing of the array are discussed. The sensitivity of the beam formation process is considered in depth. Dissert. Abstr.

N78-32954 Virginia Univ., Charlottesville.
CARBON MONOXIDE IN THE INNER GALAXY AND RELATED STUDIES OF GALACTIC STRUCTURE Ph.D. Thesis
Thomas Michael Bania 1977 132 p
Avail: Univ. Microfilms Order No. 7812133

Emission from the J = 1-0 rotational transition of C(120) O(16) has been surveyed at b = 0 deg in the region 10 deg greater than or = to l greater than or = to 352 deg with high angular and velocity resolution. The bulk of the CO within 3-4 kpc of the center is found in the nuclear region. The major emission features seen in both CO and HI are the 3-kpc arm, which is found over the entire l-range of the survey, and the nuclear disk. Unless it is significantly tilted with respect to b = 0 degs the CO data suggest that the 3-kpc arm cannot be a continuous ring structure. For the segment of the 3-kpc arm that is observed, the H2 mass inferred is less than the HI mass, M(H2) greater than or = to M(HI), which cannot constrain the explosion models that were invoked to produce the observed kinematics. In addition, there is no convincing evidence in the CO data for a resonance ring model for the 3-kpc arm. Dissert. Abstr.

N78-32955 Indiana Univ., Bloomington.
A NEW DISK SOURCE FOR THE KERR METRIC Ph.D. Thesis
Mark Robert Bernstein 1978 37 p
Avail: Univ. Microfilms Order No. 7813185

A detailed derivation of the physical structure of an m less than alpha disk is presented. The spacetime geometry of the Kerr metric is briefly described. Both the m greater than alpha (black hole) and m less than alpha (naked singularity) cases are considered. The metric's locally nonrotating and locally rotating stationary observers are introduced and the local, orthonormal-tetrad reference frames they carry are outlined. The extrinsic curvature junction condition is applied to the hypersurface r = 0 to obtain the structure of an infinitesimally-thin disk source for the Kerr metric. A discussion is given of the disk's structure; a microscopic picture of the disk's matter; and the disk's stability.
Dissert. Abstr.

N78-32956 California Univ., Berkeley.
STELLAR ATMOSPHERES WITH INCIDENT RADIATION: HZ HERCULIS Ph.D. Thesis
Lawrence Sven Anderson 1977 123 p
Avail. Univ. Microfilms Order No. 7812471

The solutions are presented for plane parallel, hydrostatic, radiative, and statistical (non-LTE) equilibrium atmospheres with a variety of incident spectra. The general structure is found to be qualitatively similar to that of previous analyses. The irradiated atmosphere divides onto four distinct zones. The condition that the luminosity of Her X-1 is entirely due to matter overflowing the Roche lobe of HZ Her and falling on a neutron star is sufficient to determine the gas density at the gravitational saddle between the two stars. This density corresponds almost exactly to the density at the top of the photosphere in the irradiated atmosphere, implying that the transition zone is just outside the saddlepoint. It is shown that the fact that the luminosity of Her X-1 is about one-tenth of its Eddington luminosity is related to this finding. Dissert. Abstr.

N78-32957* National Aeronautics and Space Administration, Washington, D. C.
STELLAR MAP OF NEOLITHIC MAN
Yu. P. Pskovskiy Aug. 1978 7 p ref Transl. into ENGLISH from Priroda. (USSR), no. 9, 1977 p 28-29 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASW-3199)
(NASA-TM-75468) Copyright. Avail: NTIS HC A02/MF A01 CSCL 03B

Observations made by ancient man are of great interest to present day astronomers. Drawings made by neolithic man in caves show a surprising sense of perspective. The discoveries in the Fern Grotto in California are of special interest. Photographs of cave drawings are included. Author

N78-32119# Indian Space Research Organization, Bangalore. Satellite Center.
FORMATION AND EVOLUTION OF STARS
T. M. K. Marar *In* Indian Inst. of Sci. Space Sci., Technol. and Appl.: An Overview Apr. 1978 6 p refs (For primary document see N78-32114 23-12)
Avail: NTIS HC A10/MF A01

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N78-32958 Yeshiva Univ., New York.
INTERPRETATION OF MOLECULAR ABSORPTION IN THE ATMOSPHERE OF JUPITER Ph.D. Thesis
Makiko Sato 1978 104 p
Avail: Univ. Microfilms Order No. 7813481

A fast method is developed for numerical solution of the invariant imbedding equation for the reflection function of a plane parallel layer. The two key ingredients in obtaining the fast solution are application of a tau-integration technique designed for stiff differential equations and explicit use of the fact that the high-frequency Fourier terms arise from the outer skin of the atmosphere. For a homogeneous atmosphere the resulting computing time is approximately a factor of two longer than for the efficient 'doubling' method; however, for an inhomogeneous atmosphere the method described is much faster than the 'adding' method. The spectrum of sunlight reflected by Jupiter is analyzed by comparing observations with multiple scattering computations. The analysis yields information on the vertical cloud structure at low latitudes and on the abundance of HC4 and NH3 in the atmosphere of Jupiter. Dissert. Abstr.

N78-32959 Arizona State Univ., Tempe.
PATTERN RECOGNITION STUDIES ON CHEMICAL ANALYSES OF LUNAR MATERIALS Ph.D. Thesis
Diane Daphane Pratt 1978 121 p
Avail: Univ. Microfilms Order No. 7813369

Pattern recognition studies have been used to study classification schemes for lunar samples. Regression analyses were first undertaken to determine linear relationships between the elements and oxides included in the study. Apollo 15 balsaltic sample studies uncovered two major samples types: olivine normative and quartz normative. No subcategories were found. Nineteen new samples were classified. Apollo 16 analyses in the data base included representative samples from soils and rocks returned by this mission. Five major sample types were determined with samples 60501, 66095, and 64815 being unique from this classification. Apollo 17 mare basalt samples were separated into three major classes. Twenty-eight newly analyzed rake basalts were added and assigned to one of the three major categories. Dissert. Abstr.

N78-32960*# National Aeronautics and Space Administration, Washington, D. C.
ULTRAVIOLET PHOTOMETRY OF VENUS: SCATTERING LAYER ABOVE THE ABSORBING CLOUDS
L. V. Ksanfomaliti, Ye. V. Dedova, V. G. Zolotukhin, G. I. Krasovkiy, and V. M. Filimonova Sep. 1978 29 p refs Trasnl. into ENGLISH of "Ultrafioletovaya Fotometriya Venery: Rasseivayuschiy Sloy nad Pogloshchayushchimi oblakami", Rept. PR-288 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1976 p 1-30 Original language document was announced as A77-32847 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75543; PR-288) Avail: NTIS HC A03/MF A01 CSCL 03B

Experimental measurements by ultraviolet photometers aboard Venera-9 and -10 are presented, discussed, and compared with various theoretical models of the ultraviolet structure of the atmosphere of Venus. The model in best agreement with observation provides for a finely dispersed, 8 km thick Rayleigh scattering layer above the primary cloud cover. Dark contrast details are considered to be breaks or areas of lower optical thickness in the upper scattering layer. Author

N78-32961*# National Aeronautics and Space Administration, Washington, D. C.
PRELIMINARY RESULTS OF STUDY OF INFRARED SPECTRA OF VENUS FROM THE ORBITAL SPACECRAFT VENERA-9 AND VENERA-10
V. Gnedykh, V. Zhegulev, L. Zasova, V. Moroz, N. Parfentyev, and G. Tomashova Sep. 1978 35 p refs Transl. into ENGLISH of "Predvaritelnyye Rezultaty Issledovaniya Infrakrasnogo Spektra Venera na Orbitalnykh Apparatakh Venera-9 i Venera-10", Rept. PR-273 Inst. of Space Res., Acad. of Sci. USSR, Moscow, 1976 p 1-33 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75542; PR-273) Avail: NTIS HC A03/MF A01 CSCL 03B

The infrared spectrum of Venus in the spectral range 1j6 to 2.8 was measured by means of the spectrometers aboard 'Venera-9' and 'Venera-10' orbital spacecrafts. Approximately 20 series of measurements were made near the pericenter of the orbit, each of which contains 150 spectra for each path intersecting the planet from the terminator to the limb. Phase angles lie within the limits from 60 to 120 deg. L.S.

N78-32962# Los Alamos Scientific Lab., N. Mex.
NEW RESEARCH INITIATIVES PROGRAM: CHEMISTRY IN COMET COMAE Final Report
W. F. Huebner Feb. 1978 9 p refs
(Contract W-7405-eng-36; Proj. W-219)
(LA-7096-MS) Avail: NTIS HC A02/MF A01

A general summary of the objectives and accomplishments of the program is given. A program objective, the theoretical investigation of chemical reactions in the comae of comets is briefly reviewed. The review includes: reports of seminars, proposals and funding, modelling and calculations, and abstracts of papers presented at astrophysics meetings. S.B.S.

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N78-32963 Arizona Univ., Tucson.
ELECTROMAGNETIC PROCESSES IN THE EVOLUTION OF THE SOLAR NEBULA Ph.D. Thesis
Guy Joseph Consolmagno 1978 140 p
Avail: Univ. Microfilms Order No. 7813910

The presence of a magnetic field in the early solar system has been suggested to explain details of the solar nebula. The solar nebula could be sufficiently ionized so that the magnetic field would be tied to the motions of the gas. The motions of such charged grains in a turbulent magnetic field are describetd. These particles will see a Lorentz force due to the convection of the solar magnetic field pas them at the solar wind velocity. Since the sign of this magnetic field is randomly varying, the direction of this force will be random, and the net effect will be to randomly scatter the orbital elements of these particles. The efficiency of this scattering depends on the size, density, and charge on the particles in question. Since all three parameters may be a function of composition, this scattering provides a mechanism for chemical fractionations. Several scenarios are described to illustrate how such fractionation might occur.
Dissert. Abstr.

N78-32964*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A CLOSE-UP OF THE SUN
M. Neugebauer, ed. and R. W. Davies, ed. 1 Sep. 1978 571 p refs
(Contract NAS7-100)
(NASA-CR-157734; JPL-Pub-78-70) Avail: NTIS HC A25/MF A01 CSCL 03B

NASA's long-range plan for the study of solar-terrestrial relations includes a Solar Probe Mission in which a spacecraft is put into an eccentric orbit with perihelion near 4 solar radii (0.02 AU). The scientific experiments which might be done with such a mission are discussed. Topics include the distribution of mass within the Sun, solar angular momentum, the fine structure of the solar surface and corona, the acceleration of the solar wind and energetic particles, and the evolution of interplanetary dust. The mission could also contribute to high-accuracy tests

of general relativity and the search for cosmic gravitational radiation. For individual titles, see N78-32965 through N78-33007.

N78-32965*# Queen Mary Coll., London (England).
THE IMPORTANCE OF DETERMINING THE SOLAR QUADRUPOLE MOMENT
Ian W. Roxburgh *In* JPL A Close-up of the Sun 1 Sep. 1978 p 11-18 refs (For primary document see N78-32964 23-92)
Avail: NTIS HC A25/MF A01 CSCL 03B

Current theoretical modelling of the sun is in difficulty. Additional observations must be made to place constraints on the plethora of conjectures that have been advanced to explain the low neutrino flux and to guide solar model builders in their search to understand the deep interior of the sun. A determination of the magnitude of the solar quadrupole moment, is one such constraint; it places limits on the density, angular velocity and magnetic field distributions inside the sun. A.R.H.

N78-32966*# Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Sciences.
POSSIBLE MEASUREMENT OF THE COEFFICIENT OF THE SECOND ZONAL HARMONIC OF THE SUN'S GRAVITATIONAL FIELD WITH A SOLAR PROBE
R. D. Reasenberg and I. I. Shapiro *In* JPL A Close-up of the Sun 1 Sep. 1978 p 19-41 refs (For primary document see N78-32964 23-92)
Avail: NTIS HC A25/MF A01 CSCL 03B

The use of radio tracking of a solar probe to estimate accurately the coefficient of the second zonal harmonic of the sun's gravitational field was examined. Preliminary results indicate that the coefficient can be estimated with a standard error of 10 to the minus 8th power or less, provided that the probe is equipped with a suitable drag-free system to compensate for the effects of non-gravitational accelerations. For signal paths that pass near the sun, dual-band ranging to the probe can provide the tracking accuracy needed to insure that the standard of error is equal to or less than 10 to minus 8th power. The possibility of achieving such accuracy with a single-band radio uplink and a dual-band downlink is discussed. A.R.H.

N78-32967*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
GRAVITATIONAL EXPERIMENTS ON SOLAR PROBE
John D. Anderson *In its* A Close-up of the Sun 1 Sep. 1978 p 42-57 refs (For primary document see N78-32964 23-92)
Avail: NTIS HC A25/MF A01 CSCL 03B

A covariance analysis was performed for a solar probe trajectory which encounters the sun at four solar radii. The unknown parameters in the analysis are the six initial cartesian coordinates for the probe, six initial cartesian coordinates for the earth, the astronomical unit, the solar gravitational quadrupole coefficient and two post Newtonian meters (beta, gamma). Errors in the unknown parameters were computed as a function of standard errors on the radio tracking data and on the nongravitational forces which act on the probe. Results were obtained for several tracking geometries and for several orbital inclinations to the ecliptic. The analysis shows that the principal scientific result from the radio tracking of a solar probe would be the determination of the quadrupole moment, which would place a constraint on models of the solar interior. A.R.H.

N78-32968*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
POSSIBLE MEASUREMENTS OF J SUB 2 AND THE SUN'S ANGULAR MOMENTUM WITH THE SOLAR PROBE
K. Nordtvedt *In its* A Close-up of the Sun 1 Sep. 1978 p 58-59 (For primary document see N78-32964 23-92)
Avail: NTIS HC A25/MF A01 CSCL 03B

The metric tensor is given for describing the dynamical effects of the sun on a solar probe and the gravitational redshift of a probe-based clock in a covariance analysis for the detectability of the solar quadrupole moment and the solar angular momentum. Unknown parameters were determined by least squares fit to the probe tracking data. A polar orbit was assumed with perihelion at 5 solar radii and with an earth-sun-probe angle of 135 deg at perihelion. Tracking was assumed to be Doppler only, with a basic uncertainity of .1 mm/sec in the radial velocity. A drag-free system which could reduce nongravitational forces below the level of 2 times 10 to the minus 12th power was found necessary to preserve this same level of accuracy. Both one way and two way Doppler were supposed in order to determine the gravitational redshift as well as the pure spacecraft dynamics. A.R.H.

N78-32969*# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
COMMENTS ON THE DRAG-FREE CONTROL OF A SOLAR PROBE RELATIVITY MISSION
C. W. F. Everitt and D. B. DeBra *In* JPL A Close-up of the Sun 1 Sep. 1978 p 60-68 refs (For primary document see N78-32964 23-92)
Avail: NTIS HC A25/MF A01 CSCL 03B

A spacecraft going within 4 solar radii of the Sun experiences an acceleration up to .00005 g from solar radiation pressure, and significant (though smaller) accelerations from the solar wind. To obtain satisfactory information about relativistic effects and the Sun's quadrupole mass coefficient, these non-gravitational accelerations are either measured or compensated out by making the spacecraft drag free. A proof mass inside the spacecraft structure is shielded from the external forces, so that it follows a nearly ideal gravitational orbit, and a control system activates gas jets (or other translational forcers) to make the vehicle follow the mass. The problems are mechanizing the control laws and minimizing extraneous effects such as the self gravitational pull of the spacecraft. The extraneous forces can be averaged in one plane by having a spinning vehicle. A.R.H.

N78-32970*# Hughes Research Labs., Malibu, Calif.
MEASUREMENT OF SOLAR GRAVITATIONAL OBLATENESS WITH GRAVITY GRADIOMETERS
Robert L. Forward *In* JPL A Close-up of the Sun 1 Sep. 1978 p 69-78 refs (For primary document see N78-32964 23-92)
Avail: NTIS HC A25/MF A01 CSCL 03B

A very high sensitivity rotating gravity gradiometer onboard the spacecraft is described for measuring the gravitational oblateness of the Sun during a solar probe mission. The proposed instrument would be a self-contained structure in a thermal-vacuum-magnetic shield in the shape of a cross, with a mass of 20 kg and arm length of 1.0 m and thickness of 0.1 m. The sensor inside would have a resonant frequency of 1/30 Hz, a mechanical Q of one million and would use gravitational radiation antenna technology to achieve a sensitivity of 6 x 10 to the minus 8th power Eotvos, which would provide a measurement of the solar oblateness to an accuracy of 1.5 to 6 x 10 to the minus 8th power. The gravity gradiometer will require a spinning spacecraft, so that it will not sense the spacecraft gravity fields, but the gradiometer does not need to be at the spacecraft center of mass, or even on the spacecraft spin axis. Major problem areas to be addressed are demonstration of the instrument sensitivity prior to flight and the measurement and compensation for any residual spacecraft angular rates. A.R.H.

N78-32971*# California Univ., San Diego. Dept of Physics.
NEW PERSPECTIVES FOR SOLAR OBSERVATIONS
H. S. Hudson *In* JPL A Close-up of the Sun 1 Sep. 1978 p 81-88 (For primary document see N78-32964 23-92)
Avail: NTIS HC A25/MF A01 CSCL 03B

The merits and demerits of an approach to the Sun (more closely than about one AU) are examined. High resolution imaging (approximately 0.1 arc sec) to be obtained with the shuttle-borne solar optical telescope, will permit conclusive observations relating to the structure of the quiet solar atmosphere, sunspots, spicules, oscillations, and many other problems of solar astrophysics. Beyond this limit important unresolved structure will exist, especially in optically thin regions or in regions with strong magnetic fields. Ambiguity will remain in solar imagery because a single line of sight cannot suffice completely to untangle the vertical dimension from the two horizontal dimensions. A solar probe with a complement of solar telescopes would provide two lines of sight for solar viewing and increase knowledge of the three dimensional structure of the solar atmosphere. A.R.H.

N78-32972*# California Inst. of Tech., Pasadena.
OPTICAL OBSERVATIONS OF THE SUN FROM A SOLAR PROBE
H. Zirin *In* JPL A Close-up of the Sun 1 Sep. 1978 p 89-91

(For primary document see N78-32964 23-92)
Avail: NTIS HC A25/MF A01 CSCL 03B

The spatial resolution of solar surface structure to ultimate limits with simple instrumentation. The logic is simple: a 10 cm aperture telescope at 4 solar radii resolves the equivalent of a five meter telescope in earth orbit. Given the ease of producing a diffraction limited 10 cm telescope and the difficulty of fabricating a diffraction limited 5 meter telescope, the performance of the small telescope could well be better. The telescope described complements planned solar orbiting telescopes in earth orbit and would need only a few arcs seconds of pointing. A.R.H.

N78-32973*# California Univ., Los Angeles. Dept. of Astronomy.
SOLAR PROBE STUDIES OF THE SOLAR CONVECTION ZONE
R. K. Ulrich *In* JPL A Close-up of the Sun 1 Sep. 1978 p 92-93 (For primary document see N78-32964 23-92)
(Grant NsG-7407; NSF AST-76-20260)
Avail: NTIS HC A25/MF A01 CSCL 03B

From a distance of 3 solar radii as may be attainable with a solar probe, a resolution of 5 arc second such as would be possible from a small telescope will allow observations of solar features as small as 50 km. Because the solar probe will be as close to the sun as 0.014 AU, the effective resolution is increased a factor of 70. A 3 inch telescope on the solar probe will have resolution equivalent to a 200 inch telescope on earth. Thus observations could be carried into the size scale which presumably is responsible for the turbulent viscosity. The preferred instrument for studying the dynamics of the solar convection zone is a magnetograph operated in a Doppler mode. A Fabrey-Perot etalon can provide the spectral discrimination necessary for the measurement of velocities. The instrument can provide long time base observations of the solar p-mode oscillations and permit determination of the rate of solar rotation at a depth 25% below the solar surface to an accuracy of better than 0.5 km/s. A.R.H.

N78-32974*# American Science and Engineering, Inc., Cambridge, Mass.
DETERMINATION OF THE STRUCTURE AND HEATING MECHANISMS OF CORONAL LOOPS FROM SOFT X-RAY OBSERVATIONS WITH THE SOLAR PROBE
John M. Davis and Allen S. Krieger *In* JPL A Close-up of the Sun 1 Sep. 1978 p 94-110 refs (For primary document see N78-32964 23-92)
Avail: NTIS HC A25/MF A01 CSCL 03B

High resolution soft X-ray imaging from the solar probe is justified in terms of the expected scientific returns which include the determination of the temperature and density structure of a coronal loop. The advantages of the grazing incidence telescope over the multiple pinhole camera are discussed. An instrument package is described which includes a grazing incidence mirror, a thermal prefilter, a three position filter wheel and a focal plane detector baselined as an 800 by 800 back-illuminated charge coupled device. The structural assembly together with the data processing equipment would draw heavily on the designs being developed for the Solar Polar Mission. A.R.H.

N78-32975*# Lockheed Missiles and Space Co., Palo Alto, Calif.
HIGH RESOLUTION STEREOSCOPIC X-RAY IMAGING OF CORONAL FEATURES DURING A SOLAR PROBE FLYBY
Dayton W. Datlowe *In* JPL A Close-up of the Sun 1 Sep. 1978 p 111-117 refs (For primary document see N78-32964 23-92)
Avail: NTIS HC A25/MF A01 CSCL 03B

The possible role of solar probe mission in answering fundamental questions about the structure and heating of coronal loops is examined. The experimental technique consists of imaging 1-10 keV X-rays to give accurate temperature profiles of hot active regions and post-flare loops. A limitation on the interpretation of such pictures is that steroscopic reconstruction of the three dimensional arches requires many lines of sight. This kind of information can be provided only by a rapid solar flyby. In addition, the proximity to the sun will provide useful spatial resolution with compact instrumentation. The pictures thus obtained will provide crucial tests of theoretical models of coronal arches. Author

N78-32976*# Stanford Univ., Calif.
THE ANALYSIS OF HIGH SPATIAL RESOLUTION UV AND X-RAY IMAGES BY COMPUTATIONAL MODELING
J. F. Vesecky, S. K. Antiochos, and J. H. Underwood *In* JPL A Close-up of the Sun 1 Sep. 1978 p 118-131 refs (For primary document see N78-32964 23-92)
Avail: NTIS HC A25/MF A01 CSCL 03B

Very high resolution stereoscopic images of high temperature loop structures observed at UV and X-ray wavelengths in the solar corona can be used to understand physical processes in the corona. An existing computational model is described and sample results are given to demonstrate that computational modeling of coronal structures can indeed take advantage of very high resolution images. The sample results include the run of temperature and number density along a typical loop and the variation of the differential emission measure with temperature. The integration of the differential emission measure with temperature along a column commensurate with an instrument's spatial resolution is the relevant parameter obtained from UV and X-ray observations. The effects of loop geometry and energy input are examined. A.R.H.

N78-32977*# California Univ., San Diego.
HARD X-RAY IMAGING FROM THE SOLAR PROBE
H. S. Hudson *In* JPL A Close-up of the Sun 1 Sep. 1978 p 132-142 refs (For primary document see N78-32964 23-92)
Avail: NTIS HC A25/MF A01 CSCL 03B

The solar probe offers a platform with particular advantages for studying solar nonthermal plasma processes via the observations of hard X-radiation from energetic electrons in the chromosphere and corona, these include (1) high sensitivity, (2) a second line of sign (in addition to the earth's) that can aid in three dimensional reconstruction of the source distribution, and, (3) the possibility of correlation with direct measurements of the nonthermal particles from the probe itself. A.R.H.

N78-32978*# State Univ. of New York at Albany. Space Astronomy Lab.
MULTICOLOR IMAGING AND PHOTOPOLARIMETRY: DISK FEATURES, K AND F CORONAS, ZODIACAL LIGHT
J. L. Weinberg and R. M. Macqueen (National Center for Atmospheric Research, Boulder, Colo.) *In* JPL A Close-up of the Sun 1 Sep. 1978 p 143-154 refs (For primary document see N78-32964 23-92)
Avail: NTIS HC A25/MF A01 CSCL 03B

The unique vantage points and viewing geometries afforded by a close-in solar probe are briefly examined with regard to line and continuum measurements of features on the solar disk, the K and F coronas, and the zodiacal light. Common instrument and observing requirements are identified, suggesting that a single instrument could provide much of the necessary observational data on these phenomena. Author

N78-32979*# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
MAGNETIC FIELD MEASUREMENTS FROM THE SOLAR PROBE
A. M. Title *In* JPL A Close-up of the Sun 1 Sep. 1978 p 155-158 (For primary document see N78-32964 23-92)
Avail: NTIS HC A25/MF A01 CSCL 03B

An optical system for the solar probe is described as well as its capability for improvements in spatial resolution. A magnetograph for measuring the elementary flux tube and obtaining vector geometry field geometry offers the possibility of looking for low contrast weak structure. With the probe's orbit passing over the pole, the structure of the polar field can be directly measured. The detector plane of the system receives a telecentric image of the objective. Because there is an aperture in this focal plane that can both move and change size, polarized line profiles can be obtained at arbitrary points with variable spatial resolution. The telescope microprocessor searches for the magnetic elements and then constructs the vector field. A.R.H.

N78-32980*# California Univ., Riverside. Inst. of Geophysics and Planetary Physics.
A NEW USE OF HIGH RESOLUTION MAGNETOGRAMS
P. J. Baum and A. Bratenahl *In* JPL A Close-up of the Sun

1 Sep. 1978 p 159-169 refs (For primary document see N78-32964 23-92)
(Grant NSF ATM-76-23463)
Avail: NTIS HC A25/MF A01 CSCL 03B

Ground-based solar magnetograms are frequently in error by as much as twenty percent and contribute to the poor correlation between magnetic changes and solar flares. High resolution measurement of the magnetic field component, which is normal to the photosphere and measured at photospheric height, can be used to construct a magnetic flux partition function F. Therefore, dF/dt is an EMF which drives atmospheric currents in reconnecting solar active regions. With a high quality magnetograph, the solar probe can be used to obtain good estimates of F and dF/dt and thereby the energy stored as induced solar atmospheric currents during quiescent interflare periods. Should a flare occur during a favorable observing period, the present method of analysis should show characteristic signatures in F, DF/dt, and especially, in the stored flux computed from dF/dt. A.R.H.

N78-32981*# Maryland Univ., College Park. Dept. of Physics and Astronomy.

STUDIES OF ACCELERATION PROCESSES IN THE CORONA USING ION MEASUREMENTS ON THE SOLAR PROBE MISSION

George Gloeckler *In* JPL A Close-up of the Sun 1 Sep. 1978 p 173-190 refs (For primary document see N78-32964 23-92)
(Grant NGR-21-002-224; NGR-21-002-316)
Avail: NTIS HC A25/MF A01 CSCL 03B

The energy spectra and composition of particles escaping from the Sun provide essential information on mechanisms responsible for their acceleration, and may also be used to characterize the regions where they are accelerated and confined and through which they propagate. The suprathermal energy range, which extends from solar wind energies (approximately 1 KeV) to about 1 MeV/nucleon, is of special interest to studies of nonthermal acceleration processes because a large fraction of particles is likely to be accelerated into this energy range. Data obtained from near earth observations of particles in the suprathermal energy range are reviewed. The necessary capabilities of an a ion composition experiment in the solar probe mission and the required ion measurements are discussed. A possible configuration of an instrument consisting of an electrostatic deflection system, modest post acceleration, and a time of flight versus energy system is described as well as its possible location on the spacecraft. A.R.H.

N78-32982*# California Univ., Berkeley. Space Sciences Lab.

ELECTRON STUDIES OF ACCELERATION PROCESSES IN THE CORONA

R. P. Lin *In* JPL A Close-up of the Sun 1 Sep. 1978 p 191-204 refs (For primary document see N78-32964 23-92)
(Grant NGL-05-003-017)
Avail: NTIS HC A25/MF A01 CSCL 03B

The solar probe mission can obtain unique and crucially important measurements of electron acceleration, storage, and propagation processes in the corona and can probe the magnetic field structure of the corona below the spacecraft. The various energetic electron phenomena which will be sampled by the Solar Probe are described and some new techniques to probe coronal structures are suggested. A.R.H.

N78-32983*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

PROBING THE SOLAR CORONA WITH ENERGETIC PARTICLES

M. A. I. VanHollebeke *In* JPL A Close-up of the Sun 1 Sep. 1978 p 205-218 refs (For primary document see N78-32964 23-92)
Avail: NTIS HC A25/MF A01 CSCL 03B

Representative sets of recent experimental results and theoretical studies are summarized to show the current knowledge of energetic particle phenomena based mainly on observations near 1 AU. Measurements close to the sun of quantities such as particle spectra, charge and isotopic composition, and the flow of particles as a function of time, together with measurements of the plasma, magnetic field, X-rays, and gamma rays will not only reveal the properties of the source region and acceleration mechanisms but will also provide a better knowledge of the physics of the corona. These measurements may also reveal the existence of large scale inhomogeneities in the solar corona. The general requirements for making these measurements on the solar probe are listed. An energetic particle detector system which has the capability of resolving the charge and isotopic composition up to 50 MeV/nucleon may successfully measure the above quantities provided that it can perform under both very low and average intensity levels. A.R.H.

N78-32984*# Johns Hopkins Univ., Laurel, Md. Applied Physics Lab.

CORONAL PROPAGATION AND STORAGE AT ENERGIES APPROXIMATELY 1 MeV/NUCLEON

E. C. Roelof, S. M. Krimigis, and R. E. Gold *In* JPL A Close-up of the Sun 1 Sep. 1978 p 219-233 refs (For primary document see N78-32964 23-92)
(Contract N00024-78-C-5384; Grant NSF ATM-76-23816; NSF ATM-76-81099)
Avail: NTIS HC A25/MF A01 CSCL 03B

Energetic particle events relating to quasi-stationary particle populations, solar flare events, and solar composition are discussed in the context of similar observations likely to be made during solar probe encounter. Particlar emphasis is given to interrelationships with coronal magnetic structure and plasma processes. General instrumental requirements are listed, and it is concluded that energetic particle detectors meeting these requirements will successfully complement other essential experiments on the Solar Probe. A.R.H.

N78-32985*# Utrecht State Univ. (Netherlands). Space Research Lab.

LOW-ENERGY PROTONS: GRADIENTS IN INTERPLANETARY SPACE AND DISTRIBUTION IN THE SOLAR CORONA

G. A. Stevens, J. J. vanRooijen, Z. Svestka, and C. deJager *In* JPL A Close-up of the Sun 1 Sep. 1978 p 234-239 ref (For primary document see N78-32964 23-92)
Avail: NTIS HC A25/MF A01 CSCL 03B

First and second order anisotropy measurements are proposed as a tool for studying the coronal source function and interplanetary propagation of low energy protons. Optimum orbit and attitude requirements are suggested for a three telescope system. Some limitations with regard to the lower energy limit for a feasible set-up are discussed. Author

N78-32986*# Chicago Univ., Ill. Dept. of Physics.

SOLAR NEUTRON SPECTROSCOPY NEAR THE SUN

J. A. Simpson *In* JPL A Close-up of the Sun 1 Sep. 1978 p 243-261 refs (For primary document see N78-32964 23-92)
Avail: NTIS HC A25/MF A01 CSCL 03B

A brief note is summarized to show the importance of solar neutron observations for the advancement of phenomena crucial for solar physics, and to suggest the constraints which must be placed on the Solar Probe Mission for carrying out studies of this kind. G.Y.

N78-32987*# New Mexico Univ., Albuquerque. Dept. of Physics and Astronomy.

ON NEUTRONS FROM THE SUN

H. S. Ahluwalia *In* JPL A Close-up of the Sun 1 Sep. 1978 p 262-270 refs (For primary document see N78-32964 23-92)
Avail: NTIS HC A25/MF A01 CSCL 03B

A survey of all the experiments carried out over the past decade to verify theoretical predictions for the observation of solar neutrons is presented and discussed. The conclusions drawn from this discussion are: (1) the Solar Probe Mission is important in order to discover the low energy neutrons of solar origin; (2) this discovery is likely to carry very useful information about the nature, the locale, the lifetime and the mode of operation of the acceleration processes in the solar atmosphere; and (3) this information will lead to a rapid development of the science of solar meteorology and the more rapid forecasting of solar activity, on a long-term basis. G.Y.

N78-32988*# Los Alamos Scientific Lab., N. Mex.
SOLAR WIND SCIENCE FOR A SOLAR PROBE MISSION
William C. Feldman *In* JPL A Close-up of the Sun 1 Sep. 1978 p 273-280 refs (For primary document see N78-32964 23-92)
Avail: NTIS HC A25/MF A01 CSCL 03B

Scientific objectives for solar-wind investigations relevant to a Solar Probe mission are outlined and put in perspective. Information gained from the various possible measurements are also listed. Author

N78-32989*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
PLASMA WAVES NEAR THE SUN: ADVANCES POSSIBLE WITH A SOLAR PROBE
Donald A. Gurnett *In* JPL A Close-up of the Sun 1 Sep. 1978 p 281-317 refs (For primary document see N78-32964 23-92)
Avail: NTIS HC A25/MF A01 CSCL 03B

A review is presented of current experimental and theoretical knowledge of plasma waves in the solar wind, with comments on the scientific importance of obtaining plasma wave measurements in the region near the sun with the solar probe. The waves discussed include the acoustic waves and shocks which are thought to be the primary source for heating the solar corona, Alfven waves, ion-cyclotron waves, whistler-mode turbulence, ion-acoustic waves, and electron plasma oscillations associated with solar radio emissions. A discussion is presented of the types of measurements which would be needed to study these waves on the solar probe, the constraints imposed on the spacecraft and the research and development which would be needed to provide the necessary instrumentation. Author

N78-32990*# Massachusetts Inst. of Tech., Cambridge.
THE SOLAR PROBE AND CORONAL DYNAMICS
J. Belcher, M. Heinemann (Boston College, Chestnut Hill, Mass.), and C. Goodrich *In* JPL A Close-up of the Sun 1 Sep. 1978 p 318-333 refs (For primary document see N78-32964 23-92)
Avail: NTIS HC A25/MF A01 CSCL 03B

The discovery of coronal holes led to basic changes in ideas about the structure of the low corona and its expansion into the solar wind. The nature of the energy flux is not understood. Current ideas include enhanced thermal conductivities, extended MHD wave heating, and wave momentum transfer, all in rapidly diverging geometries. There is little feel for the relative importance of these processes. The Solar Probe, with its penetration deep into the solar corona, could lead to observational constraints on their relative importance, and thus to an understanding of the origin of the solar wind. Observations from the Solar Probe will also bear on such questions as to whether small scale 'intrastream' structure is common close to the Sun in open field-line regions, whether the properties of the wind are pronouncedly different over closed and open field-line regions at five solar radii, and many others. The resolution of these questions requires measurements of the magnetic field and of the proton and electron distribution functions. Author

N78-32991*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ACCELERATION AND HEATING OF THE SOLAR WIND
Aaron Barnes *In* JPL A Close-up of the Sun 1 Sep. 1978 p 334-344 refs (For primary document see N78-32964 23-92)
Avail: NTIS HC A25/MF A01 CSCL 03B

Some of the competing theories of solar wind acceleration and heating are reviewed, and the observations that are required to distinguish among them are discussed. In most cases what is required is measurement of plasma velocity and temperature and magnetic field, as near the sun as possible and certainly inside 20 solar radii; another critical aspect of this question is determining whether a turbulent envelope exists in this inner region, and if so, defining its properties. Plasma and magnetic observations from the proposed Solar Probe mission would thus yield a quantum jump in our understanding of the dynamics of the solar wind. Author

N78-32992*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A SOLAR WIND EXPERIMENT FOR THE SOLAR PROBE MISSION
K. W. Ogilvie *In* JPL A Close-up of the Sun 1 Sep. 1978 p 345-353 refs (For primary document see N78-32964 23-92)
Avail: NTIS HC A25/MF A01 CSCL 03B

Electron and ion plasma measurements on Solar Probe are important, especially to elucidate the role of coronal holes as sources of the solar wind and to resolve the long debated question of the importance of wave heating within 20 solar radii to the acceleration of the solar wind. Adaptable instruments are required to cover the large dynamic range of parameters between 1 AU and 4 solar radii. The baseline mission would be improved, in some respects, by the addition of a second spacecraft, following the first by a distance of several solar radii. A spinning spacecraft would be satisfactory, but not essential, for the present objectives. Attention should be paid to having the heat shield electrically conducting. An instrument for ion and electron (but no composition) measurements would have a mass of approximately 10 kg, require 8 w of power, and generate data at a maximum rate of approximately 2 kbits/sec. Author

N78-32993*# Harvard-Smithsonian Center for Astrophysics, Cambridge, Mass.
SPECTROSCOPIC MAPPING OF SOLAR WIND VELOCITIES
John L. Kohl *In* JPL A Close-up of the Sun 1 Sep. 1978 p 354-365 refs (For primary document see N78-32964 23-92)
Avail: NTIS HC A25/MF A01 CSCL 03B

During the total solar eclipse of 1970, measurements of resonantly scattered Lyman-alpha radiation from the solar corona revealed a means to determine temperatures and densities in the solar corona beyond 1.5 R solar radii. A natural extension of this work is to use the Solar Probe to measure the spectral line profile of Lyman-alpha radiation backscattered toward the Sun from coronal regions between 4 R solar radii and 10 R solar radii. The backscattered profile would provide unique and quantitative determinations of the outlaw velocities of coronal material into the solar wind. Such information is of critical importance for understanding solar-wind formation and solar-terrestrial effects on the earth's climate. There is no known way to obtain this information without a Solar Probe-type mission. Author

N78-32994*# National Oceanic and Atmospheric Administration, Boulder, Colo.
MAGNETOHYDRODYNAMIC SIMULATION OF CORONAL MASS EJECTIONS INTO THE SOLAR WIND
M. Dryer, S. T. Wu, R. S. Steinolfson, E. Tandberg-Hanssen, and R. M. Wilson *In* JPL A Close-up of the Sun 1 Sep. 1978 p 367-387 refs (For primary document see N78-32964 23-92)
Avail: NTIS HC A25/MF A01 CSCL 03B

A state of the art fluid continuum technique to describe the MHD transient respose of the corona below 10 solar radii during two well observed events (flares on 21 August 1973 and 5 September 1973) is reviewed. It is concluded that the computer simulation should be subjected to in situ verification of as many of its initial assumptions as possible. Its ability to provide a rational basis for physical understanding of mass ejections suggests its use as one of the tools used in the planning and analysis of such encounter missions. G.Y.

N78-32995*# California Univ., San Diego.
SCINTILLATION OBSERVATIONS NEAR THE SUN
W. A. Coles, B. J. Rickett, and S. L. Scott (Owens Valley Radio Observatory, Big Pine, Calif.) *In* JPL A Close-up of the Sun 1 Sep. 1978 p 388-396 refs (For primary document see N78-32964 23-92)
Avail: NTIS HC A25/MF A01 CSCL 03B

Results on the electron density spectrum, the random velocity and the mean velocity of the solar wind in the region from 5 to 100 solar radii are presented. Results are based on intensity scintillations of incoherent radio sources at different locations and different radio frequencies. The shape of the electron density irregularity spectrum is shown to be well modeled by a power law in wavenumber with a slope that abruptly steepens at higher wavenumbers. This two slope power law model is shown to have a break (defined as the wavenumber of the change of slope) that increases with decreasing distance from the Sun.

The fractional random velocity is shown to be insignificant at distances of greater than 40 solar radii, but shows a steady increase with decreasing solar distance inside of 40 solar radii. G.Y.

N78-32996*# SRI International Corp., Menlo Park, Calif.
PLASMA DENSITY MAPPING IN THE SOLAR WIND THROUGH USE OF VHF RADIO TO MEASURE ELECTRON CONTENT
Thomas A. Croft *In* JPL A Close-up of the Sun 1 Sep. 1978 p 397-407 refs (For primary document see N78-32964 23-92)
Avail: NTIS HC A25/MF A01 CSCL 03A

How the electron content between the Solar probe and the earth can be observed with a minimum of equipment and give a quantitative rationale for the use of a signal near 400 MHz to supplement the telecommunications signal is described. The emphasis is on the method of making content observations and on their value. While far from the Sun, the electron content is so low that the S-X dual-frequency system is insufficiently sensitive and a UHF system is optimum. As the probe approaches the Sun, the UHF may be disrupted by scintillation and the variations of the telecommunications signal must be used for the content measurement. By operating the suggested system in different modes as the solar distance changes, operation during the entire mission is possible. G.Y.

N78-32997*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
WHAT IS THE FATE OF INTERPLANETARY DUST
Martha S. Hanner *In its* A Close-up of the Sun 1 Sep. 1978 p 411-419 refs (For primary document see N78-32964 23-92)
Avail: NTIS HC A25/MF A01 CSCL 03B

The following general picture of the interplanetary dust is presented: (1) size distribution; (2) spatial distribution; (3) composition; (4) dynamics; and (5) origin. The solar probe mission provides a unique opportunity to study the evolution of the interplanetary dust and its eventual destruction near the sun. Two destructive processes (fragmentation and vaporization) of interplanetary dust are discussed. G.Y.

N78-32998*# Michigan Univ., Ann Arbor. Space Physics Research Lab.
ZODIACAL LIGHT DYNAMICS EXPERIMENT: A WIDE-BAND IMAGING FABRY-PEROT INTERFEROMETER
D. G. Torr, E. Young, M. R. Torr, and A. F. Nagy *In* JPL A Close-up of the Sun 1 Sep. 1978 p 420-429 ref (For primary document see N78-32964 23-92)
Avail: NTIS HC A25/MF A01 CSCL 03B

The Solar Probe will provide an ideal platform from which to study dynamics of dust particles near the sun by measuring the detailed character of the Fraunhofer structure of the zodiacal light. The suggested instrument is a wideband imaging Fabry-Perot interferometer with state of the art technology in both the optics and the detector. The instrument would function as a high-resolution imaging device providing wavelength resolution of 0.03 A over about a 20 A range. The wideband imaging capability would provide sky maps of the zodiacal light on a despun spacecraft without mechanical scanning. The Solar Probe mission would allow the velocity distribution of the dust to be mapped along most of the trajectory of the spacecraft. Author

N78-32999*# California Inst. of Tech., Pasadena.
GRAVITATIONAL WAVE DETECTION WITH THE SOLAR PROBE: I. MOTIVATION
Kip S. Thorne *In* JPL A Close-up of the Sun 1 Sep. 1978 p 433-440 refs (For primary document see N78-32964 23-92)
Avail: NTIS HC A25/MF A01 CSCL 03B

Questions are posed and answered through discussion of gravitational wave detection with the Solar Probe. Discussed are: (1) what a gravitational wave is; (2) why wave detection is important; (3) what astrophysical information might be learned from these waves; (4) status of attempts to detect these waves; (5) why the Solar Probe is a special mission for detecting these waves; (6) how the Solar Probe's expected sensitivity compares with the strength of predicted gravitational waves; and (7) what gravity wave searchers will do after the Solar Probe. G.Y.

N78-33000*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
GRAVITATIONAL WAVE DETECTION WITH THE SOLAR PROBE. II. THE DOPPLER TRACKING METHOD
Frank B. Estabrook *In its* A Close-up of the Sun 1 Sep. 1978 p 441-449 refs (For primary document see N78-32964 23-92)
Avail: NTIS HC A25/MF A01 CSCL 03B

How gravitational radiation affects Doppler tracking is briefly described. The status of the analyses of the sensitivities achievable with the NASA-JPL Deep Space Network(DSN) is given. G.Y.

N78-33001*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRANSMISSION MEDIA EFFECTS ON PRECISE DOPPLER TRACKING
Phillips S. Callahan *In its* A Close-up of the Sun 1 Sep. 1978 p 450-456 refs (For primary document see N78-32964 23-92)
Avail: NTIS HC A25/MF A01 CSCL 03B

The effects of the transmission media - the earth's troposphere and ionosphere, and the solar wind - on precise Doppler tracking are discussed. The charged particle effects can be largely removed by dual frequency observations; however there are limitations to these corrections (besides system noise and/or finite integration times) including the effects of magnetic fields, diffraction, and differential refraction, all of which must be carefully evaluated. The earth's troposphere can contribute an error of delta f/f approximately 10 to the minus 14th power. Author

N78-33002*# Harvard Coll. Observatory, Cambridge, Mass.
A TIMED-CORRELATED FOUR-LINK DOPPLER TRACKING SYSTEM
R. F. C. Vessot and B. W. Levine *In* JPL A Close-up of the Sun 1 Sep. 1978 p 457-497 refs Prepared in cooperation with Smithsonian Astrophysical Observatory, Cambridge, Mass. (For primary document see N78-32964 23-92)
Avail: NTIS HC A25/MF A01 CSCL 03B

Phase perturbations that occur in the following components of the one and two-way systems are considered: (1) one-way system (signal from A to B): station a oscillator - transmitter A antenna A - signal path - antenna B - receiver B station B oscillator - recording system B; (2) two-way system (signal from A to B back to A): station A oscillator - transmitter A - antenna A - signal path up - antenna B - transponder B - antenna B - signal path down - receiver A - station A oscillator - recording system A. A symmetrical one- and two-way system which can identify the place of origin of the fluctuation and quantify it so as to recover the unperturbed phase at a given moment of time by time-correlating the phase fluctuations obtained in the one- and two-way data taken at both stations is described G.Y.

N78-33003*# Rochester Univ., N. Y. Dept. of Physics and Astronomy.
DETECTION OF GRAVITATIONAL RADIATION AND OSCILLATIONS OF THE SUN VIA DOPPLER TRACKING OF SPACECRAFT
D. H. Douglas *In* JPL A Close-up of the Sun 1 Sep. 1978 p 498-517 refs (For primary document see N78-32964 23-92)
Avail: NTIS HC A25/MF A01 CSCL 03B

The magnitude of Doppler signals produced by gravitational wave burst, continuous gravitational waves, and oscillations of the sun interacting with a spacecraft are considered. Expressions are worked out for the appropriate noise entering each measurement. The noise sources considered are the Doppler extractor, fluctuations in the solar wind and the troposphere, and fluctuations in the reference oscillator. Author

N78-33004*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOLAR PROBE STUDY
James E. Randolph *In its* A Close-up of the Sun 1 Sep. 1978 p 521-534 refs (For primary document see N78-32964 23-92)
Avail: NTIS HC A25/MF A01 CSCL 03B

Realistic options for a Solar Probe Mission consistent with known technical, fiscal, and programmatic constraints are identified. A program plan for NASA which includes identification of necessary research and development activities is developed. A baseline mission and a strawman spacecraft design were selected and used to determine the feasibility of meeting the mission requirements and the sensitivity to variations in those requirements. G.Y.

N78-33005*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
BALLISTIC TRAJECTORIES
D. F. Bender *In its* A Close-up of the Sun 1 Sep. 1978 p 521-534 (For primary document see N78-32964 23-92)
Avail: NTIS HC A25/MF A01 CSCL 03B

The only ballistic trajectory mode feasible for a close solar probe or for an orbit inclined approximately 90 degrees to the ecliptic is the Jupiter gravity assisted mode. A comparison of the trajectories of the Solar Polar and the Solar Probe Mission for 1983 launches is shown. The geometry of the solar encounter phase is practically the same for the 4.3 year orbit achieved by a Jupiter gravity assist and for a one year orbit. Data describing the geometry of an orbit with perihelion at 4 solar radii and aphelion at Jupiter are listed. The range of apparent directions of the solar wind if it is flowing radially outward from the Sun with a speed of either 150 or 300 km/sec is shown. The minimum sun-earth-probe angle during the solar encounter as a function of the earth-node angle and the orbital inclination is also shown. If the inclination is 60 degrees or more, the minimum SEP angle is not greatly different from the 90 degree value. G.Y.

N78-33006*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ION DRIVE PERFORMANCE AND TRAJECTORIES
C. L. Yen *In its* A Close-up of the Sun 1 Sep. 1978 p 544-555 (For primary document see N78-32964 23-92)
Avail: NTIS HC A25/MF A01

The use of Solar Electric Propulsion (SEP) for the Solar Probe Mission is addressed. The dependence of the payload mass on the site of the SEP and the flight time are described on the basis of preliminary data. The range of hardware expected to be available in the 1980's is summarized. There are several classes of optimal low-thrust trajectories for the Solar Probe Mission. These are trajectory types A, B, C corresponding to one, two, or three orbital revolutions, respectively. Plots of transfer trajectories corresponding to type-A, type-A with a Venus Swingby,. type-B, and type-C with ab Icarus Rendezvous are shown. A summary of the SEP performance is given. G.Y.

N78-33007*# Queen Mary Coll., London (England).
EUROPEAN SPACE AGENCY STUDIES OF THE SOLAR PROBE
Ian W. Roxburgh *In* JPL A Close-up of the Sun 1 Sep. 1978 p 556-564 refs (For primary document see N78-32964 23-92)
Avail: NTIS HC A25/MF A01 CSCL 03B

The feasibility and scientific objectives of a solar probe were studied by a Mission Definition Group in 1975 and 1976. The orbit analysis program was developed and an extended study of the orbit analysis was done in 1977. The results of these studies are in the Report of the Mission Definition Study (1976) and an E.S.O.C. report (1978), and the reader is referred to these sources for greater details. In this report, only brief discussion on mission concept and objectives, satellite design, orbit, orbit analysis, are presented. G.Y.

N78-33008# Air Force Geophysics Lab., Hanscom AFB, Mass.
DIRECTORY OF SOLAR-TERRESTRIAL PHYSICS MONITORING STATIONS
H. E. Coffey, comp. (World Data Center A) and M. A. Shea, comp. 17 Nov. 1977 1198 p
(AF Proj. 2311)
(AD-A055001; AFGL-TR-77-0255; AFGL-SR-208; MONSEE-SPEC-Pub-1) Avail: NTIS HC A99/MF A01 CSCL 04/1

This Directory of Monitoring Sun-Earth Environment (MONSEE) Stations contains detailed information about a number of worldwide continuously monitoring stations in the network of solar-terrestrial physics disciplines. Most of the information comes from the 'Questionnaires for MONSEE Station Directory' which were returned to the International Council of Scientific Unions: (ICSU) Special Committee on Solar-Terrestrial Physics Secretary. This directory is intended to bridge the gap between the availability of continuously monitored solar-terrestrial data and the awareness of possible users of these data. The structured format of each station entry provides some degree of homogeneity, and when familiar with this format, certain information can be located at a glance. Some station entries are more detailed than others, but all identify an additional source for more information about the station and the data. A total of 1032 individual entries are included in this directory covering the following disciplines of solar-terrestrial physics monitoring: solar and interplanetary phenomena, ionospheric phenomena, flare-associated events, geomagnetic variations, aurora, cosmic rays, and airglow.
Author (GRA)

N78-33009# Panametrics, Inc., Waltham, Mass.
UV SPECTROIRRADIOMETER OF SOLAR UV FLUXES ON THE STRATCOM 8A BALLOON FLIGHT Final Report, Aug. 1977 - Jun. 1978
Bach Sellers, Frederick A. Hanser, and Jean L. Hunerwadel Jun. 1978 27 p refs Sponsored in part by Texas Univ.
(Contract DAAB07-74-C-0263)
(AD-A055775) Avail: NTIS HC A03/MF A01 CSCL 04/1

A filter wheel UV Spectroirradiometer (UVS) was used to measure solar UV fluxes in 10 bandpasses in the 200-400 nm region at altitudes up to 40 km on Stratcom 8A. Ozone layer thicknesses were derived from the balloon ascent measurements and an ozone density profile obtained. Measurements at the 39-40 km float altitude before and after local noon give a solar flux in the (220 + or - 5) nm 02-03 transmission window of .00000453 W/(sq cm-nm). Author (GRA)

N78-33010# Sandia Labs., Albuquerque, N. Mex.
ESTIMATING MONTHLY MEANS OF DAILY TOTALS OF DIRECT NORMAL SOLAR RADIATION AND OF TOTAL SOLAR RADIATION ON A SOUTH-FACING, 45 DEG, TILTED SURFACE
E. C. Boes and I. J. Hall Jul. 1977 28 p refs
(Contract EY-76-C-04-0789)
(SAND-77-0874) Avail: NTIS HC A03/MF A01

A model relating direct normal (DIV) radiation data with total horizontal (TH) radiation data was developed. With the model solar engineers can estimate DN for any site for which TH data is available. Total radiated energy on a tilted surface (TT) is also of interest to solar engineers. Empirically derived functions relating DN and TH and TT and TH are presented.
ERA

N78-33011# National Center for Atmospheric Research, Boulder, Colo.
WAVES IN INHOMOGENEOUS MOVING MEDIA WITH APPLICATION TO THE SOLAR WIND Ph.D. Thesis - Colorado Univ.
Sylvan Arnold Jacques 1977 169 p refs
(Grant NSF ATM-77-23757)
(PB-280665/1; NCAR-CT-45) Avail: NTIS HC A08/MF A01 CSCL 03B

A complete set of equations are derived for an interacting MHD system composed of waves and a slowly varying background fluid through which they propagate. The equations for the background state are valid for any MHD wave model and conserve both the total momentum and the total energy of the system. Also derived are the dispersion relation and the equation of conservation of wave action, which governs the wave amplitude. The theory is then applied to the solar wind, with particular attention to high-speed streams. Several models are constructed for both the high- and low-speed solar wind for various values of the Alfven wave energy flux at the inner boundary (1 solar radius). GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N78-33012# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
X-RAY EMISSION THROUGH A BLACK HOLE IN DENSE CLOUDS OF INTERSTELLAR MEDIUM M.S. Thesis [EMISSAO DE RAIOS-X POR UM BURACO NEGRO EM UMA NUVEM DENSA DO MEIO INTERESTELAR]

Elesbao Grigorio deSouza Jun. 1978 100 p refs In PORTUGUESE; ENGLISH summary
(INPE-1285-TPT-092) Avail: NTIS HC A05/MF A01

A theoretical model is proposed for the emission of X-rays by a black hole in a dense cloud, immersed in a magnetic field. It is based on the Schwartzman model which considers synchrotron emission (the only relevant emission mechanism) by a black hole in the interstellar medium; in this case, the emitted frequencies, whatever the mass of the black hole, do not reach X-ray frequencies, due to the low density and high temperature of the interstellar medium. However, for a black hole immersed in a dense cloud, it is possible to have densities and temperatures such as to produce X-rays with frequencies up to 7.45 x 10 to the 17th power Hz. Author

N78-33013# Nagoya Univ. (Japan). Inst. of Plasma Physics.
HOT INTERSTELLAR MEDIUM
Satio Hayakawa Jul. 1978 37 p refs Presented at the COSPAR/IAU Symp. on X-Ray Astronomy, Innsbruck, 31 May - 3 Jun. 1978
(IPPJ-347) Avail: NTIS HC A03/MF A01

Several areas of soft X-ray emission by extended supernova remnants and the hot interstellar medium are presented. (1) X-ray features of the North Polar Spur are interpreted. (2) Several compilations of X-ray line emission are compared, the origins of differences are shown for some examples. (3) Parameters for the hot interstellar medium which surrounds the solar system are given. S.B.S.

N78-33014# Department of Energy, New York. Environmental Measurements Lab.
LUIN, A CODE FOR THE CALCULATION OF COSMIC RAY PROPAGATION IN THE ATMOSPHERE
K. Obrien Feb. 1978 22 p refs
(EML-338) Avail: NTIS HC A02/MF A01

An analytical straight-ahead transport code, LUIN, was developed for the calculation of cosmic-ray spectra, fluxes, and ionization in the earth's atmosphere. The input to the code is described, along with an ancillary code to prepare the angle-dependent rigidity cut-off input. LUIN takes into account solar modulation, the geomagnetic field, atmospheric temperature, altitude and the curvature of the earth. The code is written in FORTRAN IV for the CDC 6600 and is an update of the May 1973 code published as HASL-275. ERA

99 GENERAL

N78-33015# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY: PHYSICAL SCIENCE AND TECHNOLOGY, NO. 42
3 Aug. 1978 90 p refs Transl. into ENGLISH from various Russian journals
(JPRS-71612) Copyright. Avail: NTIS HC A05/MF A01

Articles are presented on the following topics: standard data processing in COBAL and PL-1; reliability of orbital stations; hydraulic weightlessness; communication between orbital station and control center; and remote sensing of earth resources. For individual titles, see N78-33016 through N78-33020.

N78-33016# Joint Publications Research Service, Arlington, Va.
STANDARD DATA PROCESSING MEANS IN COBOL AND PL-1 c60
Lyudmila Petrovna Babenko *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 42 (JPRS-71612) 3 Aug. 1978 p 18-29 Transl. into ENGLISH from Upravlyayushchiye Sist. i Mashiny (Kiev), no. 2, Mar. - Apr. 1978 p 59-62 (For primary document see N78-33015 23-99)
Copyright. Avail: NTIS HC A05/MF A01

An effort was made to obtain objective characterizations of the applicability of the COBOL and PL/1 languages for various aspects of data processing. L.S.

N78-33017# Joint Publications Research Service, Arlington, Va.
GUARANTEE OF THE RELIABILITY OF ORBITAL STATIONS c15
V. Simayev *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 42 (JPRS-71612) 3 Aug. 1978 p 48-53 Transl. into ENGLISH from Aviat. Kosmonavt. (Moscow), no. 6, 1978 p 34-35 (For primary document see N78-33015 23-99)
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It is stated that the efficiency of the long term operation of the manned spacecraft in orbit is predetermined by the reliability of both the orbital technical devices and the crew. A discussion is given explaining the equipment and the space crew's performance on board the spacecraft. L.S.

N78-33018# Joint Publications Research Service, Arlington, Va.
FIFTY MINUTE IN HYDRAULIC WEIGHTLESSNESS c54
A. Khorobrykh *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 42 (JPRS-71612) 3 Aug. 1978 p 54-60 Transl. into ENGLISH from Aviat. Kosmonavt. (Moscow), no. 6, 1978 p 36-37 (For primary document see N78-33015 23-99)
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A description is given of astronaut weightlessness training in an U.S.S.R. hydraulic laboratory. It is explained that the laboratory is also used to perform studies and experiments to develop and improve methods of executing many of the operations in orbit both inside and outside the station. L.S.

N78-33019# Joint Publications Research Service, Arlington, Va.
EARTH-TO-ORBITAL STATION RADIO BRIDGE c32
B. Pokrovskiy *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 42 (JPRS-71612) 3 Aug. 1978 p 61-67 Transl. into ENGLISH from Aviat. Kosmonavt. (Moscow), no. 6, 1978 p 38-39 (For primary document see N78-33015 23-99)
Copyright. Avail: NTIS HC A05/MF A01

A description is given of an U.S.S.R. flight control center and the work of controlling and monitoring a spacecraft is explained. L.S.

N78-33020# Joint Publications Research Service, Arlington, Va.
DIRECTOR OF PRIRODA CENTER STRESSES SIGNIFICANCE OF SPACE PHOTOGRAPHY c43
Yu. Kiyenko *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 42 (JPRS-71612) 3 Aug. 1978 p 68-71 Transl. into ENGLISH from Pravda (Moscow), 24 Jun. 1978 p 3 (For primary document see N78-33015 23-99)
Avail: NTIS HC A05/MF A01

A discussion is given of the U.S.S.R.'s use of space photography in studying natural resources and the environment. L.S.

N78-33021# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY: PHYSICAL SCIENCES AND TECHNOLOGY, NO. 43
9 Aug. 1978 75 p Transl. into ENGLISH from various Russian journals
(JPRS-71652) Copyright. Avail: NTIS HC A04/MF A01

Contained in this report is information on aeronautics; astronomy and astrophysics; atmospheric science; chemistry; earth sciences and oceanography; electronics and electrical engineering; energy conversion; materials; mathematical sciences; cybernetics, computers; mechanical, industrial, civil, and marine engineering; methods and equipment; missile technology; navigation, communications, detection, and countermeasures; nuclear science and technology; ordnance; physics; propulsion and fuels; space technology; and scientists and scientific organizations in the physical sciences. For individual titles, see N78-33022 through N78-33023.

N78-33022# Joint Publications Research Service, Arlington, Va.
NEED TO EXPAND USE OF COMPUTERS DISCUSSED c60
P. I. Chebayevskiy *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 43 (JPRS--71652) 9 Aug. 1978

p 1-4 Transl. into ENGLISH from Dengi i Kredit (Moscow), no. 3, 1978 p 33-35 (For primary document see N78-33021 23-99)
Copyright. Avail: NTIS HC A04/MF A01

A discussion on the need to expand the use of computers in the Soviet Union is presented. Addressed are organizational measures needed to enhance data transmission efficiency. It was suggested that it is necessary to expand further the volume and types of operations accomplished by computers. G.Y.

N78-33023# Joint Publications Research Service, Arlington, Va.
PETROV COMMENTS ON SOYUZ-28 INTERNATIONAL CREW **c12**
B. Petrov *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 43 (JPRS-71652) 9 Aug. 1978 p 14-17 Transl. into ENGLISH from Pravda (Moscow), 5 Mar. 1978 p 3 (For primary document see N78-33021 23-99)
Avail: NTIS HC A04/MF A01

A discussion is presented on the SOYUZ-28 international crew (crew made up of socialist countries). A brief history of the conditions that created the implementation of a research program with participation by international crews is presented. Some of the accomplishments of these international space flights in terms of technological achievements are discussed. G.Y.

N78-33024# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY: PHYSICAL SCIENCE AND TECHNOLOGY, NO. 44
10 Aug. 1978 92 p Transl. into ENGLISH from various Russian journals
(JPRS-71659) Copyright. Avail: NTIS HC A05/MF A01

Topics discussed include: editing and translating computer programs, debugging processors, instrument making, instrument modeling, and measurement systems. For individual titles, see N78-33025 through N78-33029.

N78-33025# Joint Publications Research Service, Arlington, Va.
GENERAL-PURPOSE INTERPRETING SYSTEM FOR EDITING AND TRANSLATING PROGRAMS FOR STANDARD-UNIT COMPUTER HARDWARE SYSTEM (ASVT) M-600 COMPUTERS **c61**
V. N. Krekov, A. N. Tsygankov, and A. I. Udod *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 44 (JPRS-71659) 10 Aug. 1978 p 1-8 Transl. into ENGLISH from Prib. Sist. Upr. (Moscow), no. 5, 1978 p 7-9 (For primary document see N78-33024 23-99)
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A general-purpose interpreting system (UIS), representing the development of an absolute system for editing and translation was developed and put into service. The main purpose of this UIS is to: (1) alter the technological process for purpose of improving the productivity of the computer programmer; (2) create maximum convenience for the programmer when working with the computer; (3) eliminate nonproductive losses of paper and machine time for preparatory operations; (4) reduce the number of system media; and (5) extend the operating resources of input-output (I/O) units. The system is simple and reliable in operation, has highly advanced functional capabilities, goes together easily with a large number of absolute routines, and adapts well. L.S.

N78-33026# Joint Publications Research Service, Arlington, Va.
PROBLEMS IN CREATION OF AN AUTOMATED DEBUGGING SYSTEM FOR THE M-7000 PROCESSOR **c61**
F. F. Buchakchiyskiy, V. F. Litvinenko, and M. A. Lobak *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 44 (JPRS-71659) 10 Aug. 1978 p 9-16 refs Transl. into ENGLISH from Prib. Sist. upr. (Moscow), no. 5, 1978 p 9-11 (For primary document see N78-33024 23-99)
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Information is given on one of the aspects of automating production which is checking the results of assembly operations and general installation of standard replacement components and bunched conductors, and debugging and testing the processor, units and complexes. L.S.

N78-33027# Joint Publications Research Service, Arlington, Va.
SCIENTIFIC INSTRUMENT MAKING PRODUCT IDENTIFICATION APPROACH DISCUSSED **c35**
A. P. Pakhomov *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., no. 44 (JPRS-71659) 10 Aug. 1978 p 46-49 refs Transl. into ENGLISH from Prib. Sist. Upr. (Moscow), no. 5, 1978 p 46 (For primary document see N78-33024 23-99)
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The problem of determining the specifics of products of the scientific instrument making industry can be reduced to segregating instruments for scientific research within the groupings put together for instruments and automation equipment for general industrial and special purposes by means of analyzing indicators of purpose and applicability. Based on this approach, 'Nomenclature of Key Types of Instruments for Scientific Research was developed in keeping with the Profile of Minpribor' and 'Instructions for Classifying Instrument Making Products under OKP Major Classification Grouping 420900--Instruments for Scientific Research.' Based on these instructions, instruments for scientific research are segregated within general industrial groupings and are coded with the digit 'nine' in the seventh and eighth digits of the 10 digit OKP code, and all nomenclature in the set was assigned the collective grouping code 420900. L.S.

N78-33028# Joint Publications Research Service, Arlington, Va.
PRODUCTION OF EXPERIMENTAL MODELS OF COMPLEX INSTRUMENTS IMPROVED **c31**
D. F. Guz, I. I. Gut, and A. I. Kukhlevskiy *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 44 (JPRS-71659) 10 Aug. 1978 p 50-53 refs Transl. into ENGLISH from Prib. Sist. Upr. (Moscow), no. 5, 1978 p 47 (For primary document see N78-33024 23-99)
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One of the major objectives for science and industry was to reduce the time required for creating and putting into service new equipment. This problem was solved successfully by making experimental models of complicated instruments under conditions of a scientific production association. L.S.

N78-33029# Joint Publications Research Service, Arlington, Va.
MEASURING AND INFORMATION SYSTEMS CONFERENCE, REVIEWED **c31**
In its Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 44 (JPRS-71659) 10 Aug. 1978 p 54-60 refs Transl. into ENGLISH from Prib. Sist. Upr. (Moscow), no. 5, 1978 p 55-58 Conf. held at Baku, 1977 (For primary document see N78-33024 23-99)
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The conference devoted special attention to: (1) problems relating to the theory and practice of computing and measuring complexes and the application of microprocessors in IIS's (measuring and information system); (2) metrological hardware for IIS's; (3) to further advances in methods of automatic error correction in IIS's and (4) the development of IIS's for problems relating to environmental protection. L.S.

N78-33030# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY: PHYSICAL SCIENCES AND TECHNOLOGY, NO. 45
14 Aug. 1978 67 p Transl. into ENGLISH from various Russian and Polish journals
(JPRS-71673) Copyright. Avail: NTIS HC A04/MF A01

The following topics are discussed: (1) Cybernetics, computers an automation technology; (2) Semiconductor crystallization; (3) Cosmonaut selection process; and (4) Space suit development. For individual titles, see N78-33031 through N78-33034.

N78-33031# Joint Publications Research Service, Arlington, Va.
CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY **c60**

I. Karimov and I. Soliyev *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 45 (JPRS-71673) 14 Aug. 1978 p 4-11 Transl. into ENGLISH from Vestn. Statist. (Moscow), no. 5, 1978 p 62-67 (For primary document see N78-33030 23-99)

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Enhancement of operational effectiveness and utilization of computers for computer information centers in the Soviet Union is discussed. Factors relating to overall economic effect were also examined. B.B.

N78-33032# Joint Publications Research Service, Arlington, Va.

POLISH SALYUT EXPERIMENT PROGRAM DESCRIBED **c12**

Robert R. Galazka *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 45 (JPRS-71673) 14 Aug. 1978 p 19-23 Transl. into ENGLISH from Zycie Warszawy (Warsaw), Special Edition, Jun. 1978 p 4 (For primary document see N78-33030 23-99)

Avail: NTIS HC A04/MF A01

Crystallization processes under zero gravity conditions, and the production of homogeneous alloys of such semiconductors were studied. Properties of semiconductor crystals were defined and possible applications were reviewed. B.B.

N78-33033# Joint Publications Research Service, Arlington, Va.

POLISH COSMONAUT SELECTION PROCESS DESCRIBED **c52**

Stanislaw Remuszko *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 45 (JPRS-71673) 14 Aug. 1978 p 24-26 Transl. into ENGLISH from Slowo Powszechne (Warsaw), 28 Jun. 1978 p 3 (For primary document see N78-33030 23-99)

Avail: NTIS HC A04/MF A01

An interview with Col. Dr. Romuald Błoszczynski, of the Military Institute of Aviation Medicine concerning the Polish cosmonaut selection process is presented. Areas of discussion include the criteria for selecting cosmonaut candidates and psychophysical characteristics they must possess. B.B.

N78-33034# Joint Publications Research Service, Arlington, Va.

DEVELOPMENT OF MODERN SPACESUITS **c54**

G. Ilin, V. Ivanov, and I. Pavlov *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 45 (JPRS-71673) 14 Aug. 1978 p 27-38 Transl. into ENGLISH from Nauka Zhizn (Moscow), no. 6, 1978 p 40-46 (For primary document see N78-33030 23-99)

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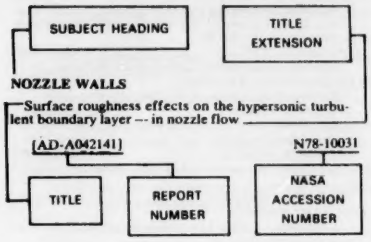
The development and successful performance of the space flight suit as an important life support system is reviewed. B.B.

Typical Subject Index Listing



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Cork-resin ablative insulation for complex surfaces and method for applying the same
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A general theory of acoustic propagation with applications to strong acoustic scattering in the atmosphere and ocean
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A general theory of acoustic propagation with applications to strong acoustic scattering in the atmosphere and ocean
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Monograph on carbon [activated charcoal] --- bibliographies
[PB-280129/8] N78-32210
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Activated carbon. Volume 1, part 1: Waste water treatment. Citations from the engineering index data base
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Activated charcoal. Citations from the engineering index data base
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ADAPTIVE CONTROL
Adaptive antenna control system
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FPLA mechanization of arithmetic elements to produce A + B or to pass A only
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Carborane burning rate modifiers
[AD-A055509] N78-32280

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Crack propagation in aluminum sheets reinforced with boron-epoxy
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Adhesive bonded aerospace structures standardized repair handbook
[AD-A055684] N78-32270

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Interactive aids for cartography and photo interpretation
[AD-A056355] N78-32530
Remote sensing of the ocean. Part 1: Physical, chemical, and geological properties, volume 2. A bibliography with abstracts
[NTIS/PS-78/0563/3] N78-32664

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AERODYNAMIC STABILITY
Aerodynamic stability testing with magnetically suspended models
N78-32108

AERODYNAMIC STALLING
Dynamic stall: An example of strong interaction between viscous and inviscid flows
[NASA-TM-75447] N78-32384

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Aeronautical Engineering: A continuing bibliography with indexes, supplement 99
[NASA-SP-7037[99]] N78-32036
Air Force Flight Dynamics Laboratory fiscal year 1979. Technical objective document
[AD-A055711] N78-32911

AEROLOGY
Study of dynamics of minor constituents in the thermosphere, addendum
[NASA-CR-145193] N78-32632

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[NASA-SP-7037[99]] N78-32036
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The capability of satellite borne remote sensors to measure stratospheric trace constituents. Volume 2: Ozone and aerosol related missions
[NASA-CR-145309] N78-32523

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[NTIS/PS-78/0522/9] N78-32650
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Sulfur dioxide control, Volume 3. Citations from the NTIS data base
[NTIS/PS-78/0654/0] N78-32218
Sulfur dioxide control. Citations from the American Petroleum Institute data base
[NTIS/PS-78/0655/7] N78-32219
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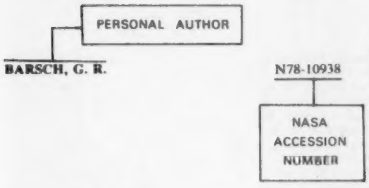

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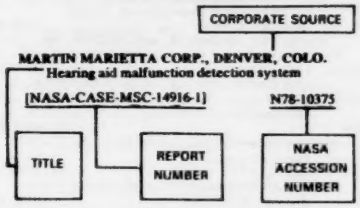

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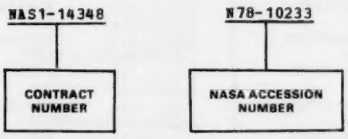

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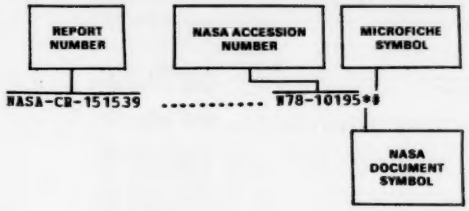

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NTIS/PS-78/0599/7 ..... N78-32586 #
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NTIS/PS-78/0602/9 ..... N78-32301 #
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NTIS/PS-78/0654/0 ..... N78-32218 #
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NTIS/PS-78/0657/3 ..... N78-32661 #
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NTIS/PS-78/0669/8 ..... N78-32779 #

NTISUB/D/276-007 ..... N78-32534*#
NTISUB/D/277-007 ..... N78-32538*#

NUSC-TR-5783 ..... N78-32734 #

NWSC/CR/EDTR-70 ..... N78-32278 #

ONERA-TP-1977-135 ..... N78-32384*#

ONR-TR-25 ..... N78-32900 #

ORAU/IEA(M)-77-33 ..... N78-32576 #
ORAU/IEA(O)-78-3 ..... N78-32575 #

ORNL-5373 ..... N78-32248 #

ORNL/FE-1 ..... N78-32283 #
ORNL/SUB-7117/9 ..... N78-32887 #
ORNL/TM-6176 ..... N78-32451 #
ORNL/TM-6214 ..... N78-32888 #
ORNL/TM-6219 ..... N78-32891 #
ORNL/TR-4612 ..... N78-32274 #

ORO-3992-319 ..... N78-32907 #
ORO-3993-320 ..... N78-32908 #

OSU-262 ..... N78-32946*#

OSURF-760100/783641 ..... N78-32200 #

OTR-78-142 ..... N78-32337 #

OWRT-A-083-NC(2) ..... N78-32532 #

OWRT-C-4067(9014)(1) ..... N78-32617 #

PANA-HIPA-1 ..... N78-32598 #

PAPEE-77-48 ..... N78-32814*#
PAPEE-77-026 ..... N78-32052*#
PAPEE-77-027 ..... N78-32054*#
PAPEE-77-073 ..... N78-32264*#

PB-279789/2 ..... N78-32666 #
PB-280124/9 ..... N78-32298 #
PB-280129/8 ..... N78-32210 #
PB-280148/8 ..... N78-32639 #
PB-280189/2 ..... N78-32291 #
PB-280266/8 ..... N78-32299 #
PB-280281/7 ..... N78-32928 #
PB-280309/6 ..... N78-32929 #
PB-280478/9 ..... N78-32713 #
PB-280547/1 ..... N78-32935 #
PB-280548 ..... N78-32452 #
PB-280559/6 ..... N78-32613 #
PB-280575/2 ..... N78-32532 #
PB-280624/8 ..... N78-32714 #
PB-280662/8 ..... N78-32934 #
PB-280664/4 ..... N78-32655 #
PB-280665/1 ..... N78-33011 #
PB-280687/5 ..... N78-32607 #
PB-280717/0 ..... N78-32609 #
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PB-280725/3 ..... N78-32611 #
PB-280727/9 ..... N78-32337 #
PB-280755/0 ..... N78-32616 #
PB-280756/8 ..... N78-32610 #
PB-280762/6 ..... N78-32394 #
PB-280920/0 ..... N78-32303 #
PB-280922/6 ..... N78-32588 #
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PB-280953/1 ..... N78-32715 #
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PB-281886/2 ..... N78-32654 #
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PB-281928/2 ..... N78-32662 #
PB-281970/4 ..... N78-32307 #
PB-282151/0 ..... N78-32658 #
PB-282152/8 ..... N78-32659 #
PB-282154/4 ..... N78-32621 #
PB-282453/0 ..... N78-32660 #

PDR-698-8 ..... N78-32098*#

PHM-01-78 ..... N78-32636 #

PIPR-930-2 ..... N78-32499 #

PNL-2508 ..... N78-32689 #
PNL-2568 ..... N78-32560 #
PNL-2597 ..... N78-32559 #

PPPL-1427 ..... N78-32890 #

PR-273 ..... N78-32961*#
PR-276 ..... N78-32313*#
PR-283 ..... N78-32838*#
PR-286 ..... N78-32314*#
PR-288 ..... N78-32960*#
PR-300 ..... N78-32113*#
PR-307 ..... N78-32633*#
PR-311 ..... N78-32837*#
PR-389 ..... N78-32752*#
PR-391 ..... N78-32730*#
PR-392 ..... N78-32729*#

PREL-77-CR-52 ..... N78-32405*#

PTPT-78-11 ..... N78-32441 #
PTPT-78-12 ..... N78-32440 #

PUBL-72-758 ..... N78-32427*#

PWA-FR-9511 ..... N78-32235 #

PWA-5501 ..... N78-32836*#
PWA-5548-9 ..... N78-32433*#
PWA-5616 ..... N78-32096*#

QR-3 ..... N78-32351 #
QR-6 ..... N78-32075*#
QR-6 ..... N78-32350 #

QTR-9-VOL-1 ..... N78-32322 #
QTR-9-VOL-2 ..... N78-32323 #

RADC-TR-78-34 ..... N78-32326 #
RADC-TR-78-43-VOL-2 ..... N78-32919 #
RADC-TR-78-43-VOL-3 ..... N78-32923 #
RADC-TR-78-43-VOL-4 ..... N78-32920 #
RADC-TR-78-61 ..... N78-32861 #
RADC-TR-78-88 ..... N78-32318 #

RAE-LIB-TRANS-1938 ..... N78-32266 #

REPT-1WW-SS-105-55 ..... N78-32647 #
REPT-3 ..... N78-32515*#
REPT-4 ..... N78-32516*#
REPT-23 ..... N78-32284 #
REPT-47 ..... N78-32501 #
REPT-78-1 ..... N78-32268 #
REPT-1326-21-01-1648-VOL-1 ..... N78-32330 #
REPT-3525/2/78 ..... N78-32442 #
REPT-7050-DG-KK-78-FR-1-DOD ..... N78-32103 #
REPT-62269/TR7-1573 ..... N78-32272 #

RI/RD78-215 ..... N78-32181*#

RLO-2332-1 ..... N78-32570 #

RHE-1099 ..... N78-32531 #

SAI-78-727-WA ..... N78-32710 #

SAND-76-5948C ..... N78-32244 #
SAND-77-0874 ..... N78-33010 #
SAND-77-0927 ..... N78-32335 #
SAND-77-2101 ..... N78-32508 #
SAND-77-8289 ..... N78-32250 #
SAND-77-8511 ..... N78-32241 #
SAND-77-8763 ..... N78-32582 #
SAND-78-0244C ..... N78-32078 #
SAND-78-0387 ..... N78-32356 #
SAND-78-0439 ..... N78-32249 #
SAND-78-0520 ..... N78-32846 #
SAND-78-7014 ..... N78-32579 #
SAND-78-8200 ..... N78-32842 #

SC5094.25FPR ..... N78-32858*#

SD-78-AP-0113 ..... N78-32164*#

SDC-TR-5772/008/02 ..... N78-32757 #

SERIAL-T-375 ..... N78-32450 #

SQUID-TR-MIT-89-PU ..... N78-32201 #

SRD-78-063 ..... N78-32391 #

SSI-7618-1 ..... N78-32111 #

STI-TR-1063-2 ..... N78-32106*#

SU-HIGL-108 ..... N78-32879 #

TAE-334-PT-1 ..... N78-32462 #

TID-28140 ..... N78-32556*#
TID-28393 ..... N78-32562 #

TM-62 ..... N78-32345*#
TM-77-7 ..... N78-32719 #

THE-312 ..... N78-32430*#

TOP-1-3-504 ..... N78-32093 #
TOP-1-3-505 ..... N78-32093 #
TOP-6-2-558 ..... N78-32333 #
TOP-7-3-500 ..... N78-32093 #

TR-1 ..... N78-32553 #
TR-2 ..... N78-32271 #
TR-7 ..... N78-32505 #
TR-14 ..... N78-32348 #
TR-20 ..... N78-32269 #
TR-27(ONR) ..... N78-32921 #
TR-28 ..... N78-32802 #
TR-53 ..... N78-32788 #
TR-61 ..... N78-32803 #
TR-78/10 ..... N78-32800 #
TR-149 ..... N78-32787 #
TR-150 ..... N78-32761 #
TR-772-1-2 ..... N78-32170 #

TRB/TRR-633 ..... N78-32299 #
TRB/TRR-634 ..... N78-32928 #

UCB/EERC-77/28 ..... N78-32307 #

UCID-17771 ..... N78-32864 #
UCID-17774 ..... N78-32843 #
UCID-30156-REV-1 ..... N78-32764 #

UCRL-13825 ..... N78-32509 #
UCRL-13827 ..... N78-32170 #
UCRL-50042-77 ..... N78-32601 #
UCRL-51873-SUPPL-1 ..... N78-32415 #
UCRL-52000-77-10 ..... N78-32572 #
UCRL-52327 ..... N78-32557 #
UCRL-52402 ..... N78-32810 #
UCRL-52418 ..... N78-32584 #
UCRL-79700 ..... N78-32416 #
UCRL-79726 ..... N78-32401 #
UCRL-79732 ..... N78-32417 #
UCRL-79886 ..... N78-32850 #
UCRL-80099 ..... N78-32884 #
UCRL-80170 ..... N78-32881 #
UCRL-80233 ..... N78-32882 #
UCRL-80323 ..... N78-32883 #
UCRL-80655 ..... N78-32844 #

UDRI-TR-77-09 ..... N78-32388 #
UDRI-TR-77-68 ..... N78-32389 #

UNC-WRRI-78-128 ..... N78-32532 #

US-PATENT-APPL-SN-48621 ..... N78-32179*
US-PATENT-APPL-SN-374421 ..... N78-32262*
US-PATENT-APPL-SN-448321 ..... N78-32261*
US-PATENT-APPL-SN-547072 ..... N78-32397*
US-PATENT-APPL-SN-562992 ..... N78-32261*
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US-PATENT-CLASS-33-366 ..... N78-32395*
US-PATENT-CLASS-60-39.07 ..... N78-32539*
US-PATENT-CLASS-60-39.14 ..... N78-32539*
US-PATENT-CLASS-60-39.33 ..... N78-32539*
US-PATENT-CLASS-60-641 ..... N78-32542*
US-PATENT-CLASS-60-671 ..... N78-32542*
US-PATENT-CLASS-62-259 ..... N78-32721*
US-PATENT-CLASS-65-30R N78-32260*
US-PATENT-CLASS-65-60D N78-32260*
US-PATENT-CLASS-73-603 ..... N78-32447*
US-PATENT-CLASS-98-1.5 ..... N78-32539*
US-PATENT-CLASS-102-103 ..... N78-32179*
US-PATENT-CLASS-106-48 ..... N78-32260*
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US-PATENT-CLASS-128-142.7 ..... N78-32721*
US-PATENT-CLASS-149-19.4 ..... N78-32179*
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